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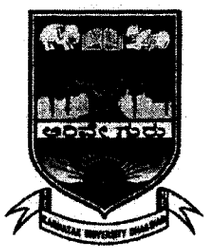
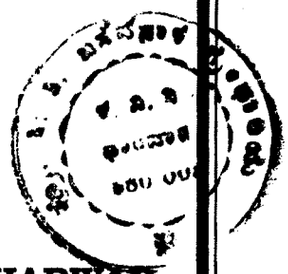
SETTLEMENT AND SUBSISTENCE PATTERNS IN THE SOUTHERN NEOLITHIC OF KRISHNA BASIN, WITH SPECIAL REFERENCE TO LITHIC ASSEMBLAGE FROM SANGANAKALLU, BELLARY DISTRICT, KARNATAKA





THESIS SUBMITTED TO KARNATAK UNIVERSITY, DHARWAD FOR THE AWARD OF THE DEGREE OF

DOCTOR OF PHILOSOPHY

IN

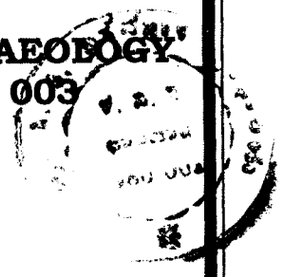
HISTORY AND ARCHAEOLOGY

By

Mr. Janardhana B.
Department of Studies in History and Archaeology,
Karnatak University, Dharwad

Research Guide

Dr. Ravi Korisettar
Department of Studies in History and Archaeology,
Karnatak University, Dharwad



DEPARTMENT OF STUDIES IN HISTORY AND ARCHAEOLOGY
KARNATAK UNIVERSITY, DHARWAD- 580 003
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2008

DECLARATION

I do hereby declare that the thesis entitled "**SETTLEMENT AND SUBSISTENCE PATTERN IN THE SOUTHERN NEOLITHIC OF KRISHNA BASIN WITH SPECIAL REFERENCE TO LITHIC ASSEMBALGE FROM SNAGANAKALLU, BELLARY DISTRICT, KARNATAKA**" is a record of independent research work carried out by me under the supervision and guidance of ***Prof. Ravi Korisettar***, Department of Studies in History and Archaeology, Karnatak University, Dharwad.

The thesis or a part thereof has not been previously submitted for any other degree to this or any other University.

Dharwad

Date: 4/ 9 / 2008

Janardhana B.

Department of Studies in History and Archaeology, Karnatak University, Dharwad.

CERTIFICATE

This is to certify that the thesis entitled **"SETTLEMENT AND SUBSISTENCE PATTERNS IN THE SOUTHERN NEOLITHIC OF KRISHNA BASIN, WITH SPECIAL REFERENCE TO LITHIC ASSEMBLAGE FROM SANGANAKALLU, BELLARY DISTRICT, KARNATAKA"** *submitted by* ***Janardhana B.*** *for the award of degree of* **DOCTOR OF PHILOSOPHY** *in* **History and Archaeology** *of the Karnatak University, Dharwad, is record of independent and original work carried out by him under my supervision and guidance.*

The Thesis or a part thereof has not been previously submitted for any other degree of diploma of this or any other University.

Place : Dharwad
Date: 04-09-2008

Prof. Ravi Korisettar
Department of Studies in History and Archaeology,
Karnatak University, Dharwad

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INTRODUCTION

By terminal Pleistocene times a trend towards domestication of plant and animal species began in some of the hunter-forager communities inhabiting various parts of the Old World. For millennia before 10,000 year ago, during the early stages of Post-glacial global warming, a world population of small, peripatetic bands of foragers faced adverse climatic interludes by inventing agriculture, switching to producing food rather than living at mercy of natural yield from edible plants and animals. There is reasonable agreement that the Paleolithic ended with the beginning of the recent (Holocene) geological and climatic era about 8000 BC. It is also clear that a developmental bifurcation in man's culture history took place at about this time. In most of the world, especially in the temperate and tropical woodland environments or along the southern fringes of Arctic tundra, the older Upper Paleolithic traditions of life were simply readapted toward more or less increasingly intensified levels of food collection. These Culture re-adaptations of older food procedures to the variety and succession of post-Pleistocene environments are generally referred to as occurring in the Mesolithic period. But also by 8000 BC (if not even somewhat earlier) in certain semi-arid environments of the world's middle latitude, traces of a quite different course of development began to appear. These traces indicate a movement toward incipient agriculture and (in one or

two instances) animal domestication. In the case of southwestern Asia, this movement had already culminated in a level of effective village farming communities by 7000 BC. It may thus be maintained that in the environmentally favorable portions of south western Asia, and perhaps in southeastern Asia (for which little evidence is available), little if any trace of the Mesolithic stage need be anticipated. The general level of culture probably shifted directly from that of the upper Paleolithic to that of incipient cultivation and domestication.

The 'Neolithic' throughout the Old World is taken to be synonymous with the earliest agriculture, due to the widespread appeal and influence of V. Gordon Childe's Concept of a 'Neolithic Revolution' (e.g. Child 1936, 1942, 1956), While the term 'Neolithic is used, especially in archaeology and anthropology, to designate a stage of cultural evolution or technological development characterized by the use of stone tools, the existence of settled villages dependent on domesticated plants and animals, and the presence of such crafts as pottery, which set it apart from the Paleolithic and Mesolithic, traits were taken, under the influence of Childe and Braid wood (Braid wood and Braidwood 1953). The Mesolithic period in several areas shows a gradual transition from a food-collecting to a food producing culture. The termination of the Neolithic period is marked by such innovations

as the rise of urban civilization or the introduction of metal tools or writing. Again, the criteria vary with each case. The earliest known development of Neolithic culture was in South west Asia between 10,000 BC and 8000 BC. There the domestication of plants and animals was probably begun by the Mesolithic Natufian people of Isral, Lebanon, and Syriya, whose cave and open air sedentary camps date to 10,000 to 8000 BC. While hunting the wild game of their region, the Natufians harvested wild grasses with a flint sickle, a composite tool of geometric microliths, and an early form of scythe (Garrod 1957; Bar-Yosef 1998). Other examples of incipient domestication in western Asia occur in early Holocene times in the Zagros mountains and Kurdish hills of Iraq, as at the Karim shahir nearly 560 km northeast of the closest Natufian sites in northeastern Iraq (Lamberg-Karlovsky and Sabloff 1995:61). All these leading to the establishment of settled villages based on the cultivation of cereals, including wheat, barley and millet, and the raising of cattle, sheep, goats, and pigs, horses and wolves abound, all wild forms but of those species later brought under domestication. Recent genetic analysis of einkorn wheat (*Triticum monoccum*) from the Karacadag mountains of southeastern Turkey suggest that the progenitor of cultivated einkorn is as ancient as 10,000 years ago (Heun et al. 1997).

In western Asia regionally distinctive food-producing cultures developing from 8000 to 3500 BC. in a number of excavated sites. Of these the best known are Jericho in Jordan, with its Natufian culture out of which emerged a preceramic Neolithic around 8350 – 7350 BC. (Kenyon 1957); Jarmo in Zagros range, which was a permanent town by the middle of the seventh millennium BC. with a ceramic tradition and mixed economy of cultivated wheat, barley, peas, and lentils combined with consumption of wild species of Sheep, Pig and gazelle (Braidwood and Howe 1960); Catal Huyuk in South-central Turkey, which by 6500 to 5400 BC. enjoyed a highly developed agricultural lefeway based on irrigation and dietary stapes of emmer, einkorn, peas, vetch, acorns, almonds, and pistachios while domestication of wild cattle, extensive trade connections with near and distant farming communities, and complex domestic and ceremonial architecture enhanced the quality of life (Mellart 1967, 1975; Shane and Kucuk 1998); the Mesopotamian sites, with a series of early food-producing cultures that includes a late Neolithic village culture of ca. 5500 BC. on the Tigries-Euphrates floodplain; the Hassuna culture of 6000 to 5250 BC. in northeastern Iraq; the Samarra culture on the Tigiris beginning around 5500 BC.; the Halaf culture east of the Tigris flourishing between 5500 and 4700 BC.; and the Ubaid culture of southern Mesopotamia dating from 4500 to 3500 BC. From the Ubadian settlements arose the Sumerian civilization

and the Babylonian urban centers by 3500 BC. (Bar-Yosef and Meadow 1995).

Between 6000 BC and 2000 BC. Neolithic culture spread through Europe, the Nile valley (Egypt), the Indus valley (India), and the Huang He valley (N. China). The formation of Neolithic cultures throughout the Old World resulted from a combination of local cultural developments with innovations diffused from the Middle East.

In Indian Border lands the process of Neolithic evolution started in the seventh-sixth millennium B.C. kili Ghul Mohammed near Quetta and Mehargarh and is well documented in the excavation of Mehargarh. The site Mehargarh is situated on the Bolan river in Baluchistan, north Kachhi plain that has been excavated since 1947 (Jarrige 1979a, 1979b, 1982, 1984a, 1984b, 1986; jarrige and Lechevallier 1979; Lechevallier and Quivron 1981; Meadow 1984). This Neolithic community engaged in the cultivation of wheat, barley, and dates and domestication of cattle, water buffalo, sheep, and goats. The first phase IA, is aceramic and a variety of stone tools were in use, but a succeeding phase include stone sickles, granaries, pottery, basketry, and seeds suggesting the cultivation of cotton (*Gossypium arboreum*). A third phase dating to 5100 B.C. shows a great variety of seeds of cultivated plants. Mud brick structures

are contemporary with the earliest Neolithic phase at Mehargarh, and they continued into period III.

Neolithic culture of India, Thapar, classified it in six different geographical regions. (i) the region covering Baluchistan, Swat and Upper Sind Valley in Pakistan, (ii) northern region covering the Kashmir valley, (iii) eastern region covering Assam, Chittagong and the sub-Himalayan regions including Darjeeling, (iv) the Chota Nagpur plateau which covers parts of present-day Orissa, Chattisgadh Jharkhand, Bihar and West Bengal, (v) mid-eastern region which comprise of parts of Bihar and Uttar Pradesh and (vi) south comprising the peninsular India (Thapar,1978). The Allchins have made divisions of distinct regions based on the physical environment, climate and the presence of wild progenitors of the domesticated crops. The divisions are (i) the Indus system and its western borderland, (ii) western India and north Deccan, (iii) the Ganga Valley and (iv) Southern Deccan (Allchin and Allchin, 1978).

It is important to note that both these scholars recognize the Southern Neolithic as a distinct cultural entity.

Broad parallels can be drawn between the Neolithic of the Baluchistan region and the neighbouring Iranian plateau and the region to the east of the Caspian Sea and the plains to the north as far as the

valley of the Oxus and 'thus appear as interrelated parts of a larger whole-geographically and even culturally' (Allchin and Allchin,1982). The northern region which comprise of the Neolithic sites in the Kashmir valley display much similarity with the Neolithic cultures of north China. "In discussing the origins and affinities of these northern Neolithic sites certain things at once strike the eye as foreign to the Indian tradition. Among them are the forms of the bone tools, the rectangular perforated stone knives, jade beads, the pit-dwellings and the placing of domestic dogs in graves with their masters. Each one of these features is found in the Neolithic cultures of north China, the perforated knife in particular being a characteristic trait. Also dog burials are reported in the Ang-Ang-Hsi culture of Manchuria." (Allchin and Allchin,1982) The Allchin and Allchin further go on to state that the bone industry, including harpoons, is also a frequent occurrence of north Chinese Neolithic sites and that the evidence of trade and more profound contacts with the Chinese world is noteworthy. But it is important to mention that the Allchin and Allchin note the absence of any similarity between the Burzahom ceramic industry and the Chinese Neolithic pottery. The Neolithic culture of eastern India including Assam and the sub-Himalayan region has yielded fully ground shouldered celts, quadrangular axes and adzes found in association with cord-marked pottery in the later stages. While the similarities between

the an earlier phase characterized by wholly chipped and edge-ground axes and the food-producing Hoabinhian culture of South-east Asia has yet to be ascertained (Gorman, 1971), the affinities between the later stage of eastern Indian Neolithic and south China and South-east Asia are clearly demonstrated by the shouldered axes and quadrangular axes. These parallels of the northwestern, northern and eastern Neolithic cultures with "foreign" counterparts makes us put the Southern Neolithic in a different perspective.

Chronologically, the Southern Neolithic is broadly placed between c.2800-1000 B.C (Allchin and Allchin, 1982). Although the Southern Neolithic is slightly later in date when compared with the Neolithic in Baluchistan and it late contemporary of the Mature Harappan period it stands out because of its distinct characteristics. The fact that it is characterized by the Ashmound tradition, the predominance of cattle-pastoralism and the inclusion of a number of millets and pulses whose wild progenitors were found in the region, have carved a distinct place for Southern Neolithic.

1.1. Previous Investigation in South India

The first discoveries of ground stone implements in south India are more than a century old. Captain New Bold's discovery of ash mounds at Kudatini and Kupgal in 1836, and Willam Fraser's discovery

of Neolithic settlements at 'North Hill' of Bellary town and Kupgal near Sanganakallu have created an inquisitiveness in Robert Bruce Foote, who after 1885 discovered nearly 200 Neolithic sites in Deccan and South India. The notable work of Foote (year?) fall in the districts of Hyderabad, Mahabubnagar, Karnool, Cuddapah, Anantapur and Guntur of Andhra Pradesh, Raichur, Chitaldurg and Bellary of Karnataka, North Archot, Salem and Tiruchinapalli and Dharmapuri in Tamilnadu. Since Foote's work in many parts of the country particularly in Deccan and south India, ground stone implements were collected in large quantities. But it was not until 1947 that the conscious attempt was made to determine the chronological and cultural contexts of the ground stone industries. Wheeler's excavations at Brahmagiri (1948: 181-310) have placed the neolithic industries of the Deccan in a chronological perspective.

Wheeler's excavation of Brahmagiri provided the necessary stimulus, where after, Neolithic sites one after the other were excavated in quick succession in different parts of south India. Such of the excavated sites include Sanganakallu (Subba Rao, B: 1948: Ansari, Z.D. and Nagaraja Rao. M.S. 1969); Nagarjunakond (Soundara rajan, 1958: 48-113; R. Subrahmanyam et.al. 1975) Piklihal (Allchin, F.R. 1960); Utnur (Allchin, F.R. 1961);Maski (Thapar, B.K. 1975: 4-142);

Kesarapalle (Serkar,H. 1962) Tekkalakota (Nagaraja Rao and Malhotra 1965), Hallur (Nagaraja Rao, M.S. 1971). Paiyampalle (Rao, S.R. 1968-26-30); T. Narasipur (Seshadri, M. 1971); Terdal (Sundara. A. 1969-70:23-33); Jami (Ramachandrayya, and Subrahmanyam, 1971); Kodekal (Paddayya, K. 1973); Veerapuram (Sastry, T.V.G. *et al.* 1984); Dalmalai and Totarapalli (Narasimhaiah, B. 1980) etc. The evidence furnished by these excavations has gone a long way to add to our knowledge of the life and times of Neolithic in South India.

The study of south Indian Neolithic as did Prof. Allchin, F.R. He has shown that the Neolithic of south India underwent a long evolutionary process culminating in the beginning of the urban centers in the first millennium BC. This long process of evolution which covered a time span of over 1500 years was divided by him into three phases, the early Neolithic, the mature Neolithic and late Neolithic (Allchin, F.R.B.1968: 161-170). Each of these temporal divisions id characterized by certain distinctive features of its own. The present writer while appreciating the three fold division proposed by Allchins, tried to project the cultural attributes of Neolithic in south India more comprehensively to suit all the available excavated data.

The earlier settlements were made by a people who made ground stone-axe industry and had flake and blade tradition. They domesticated

cattle, sheep and goats. Their pottery, but a less common ware had a black or red burnished slip. Often with purple-painted decoration. A feature of the grey ware was the use of bands of red ochre applied after firing. Other note worthy features of this early pottery are the applied ring feet and hollow pedestals, recalling those of pre-Harappan Amri or Kalibangan. The settlements were usually made on the hillsides, or on Saddles or plateaus between two or more such hills. They also made forest cattle stations, probably for seasonal grazing. Terracotta figurines are predominantly those of humped cattle and rock paintings and rock bruisings around the settlements are also predominantly of cattle. From the earliest levels number of rubbing stones and querns are found, suggesting some sort of grain production. The radiocarbon dating is represented of this early phase between 2300 to 1800 BC.

During the second phase some important developments took place. Mud floor are in evidence, and circular hutments of wattle and daub on a wooden frame. The stone axe industry proliferated. There is a great increase in the number and regularity of stone blades prepared from small blade cores of various siliceous stones. Red and black slipped wares more or less completely disappear from the range of pottery: on the other hand new elements appear, suggesting contact with regions to the north. Among these are perforated vessels, and the

practice of roughening the outer surface of vessels in a manner reminiscent of that employed in Baluchistan in pre-Harappan levels, and spouts make their first appearance. There is nevertheless a basic continuity diseremible between these two periods. The first metal objects, of both bronze and copper, appear with increasing frequency towards the end of this period. The radiocarbon dating of this phase is between 1800 BC to 1500 BC.

In the third phase is an increase in the number of tools of copper and bronze, although the axe and blade industries in stone continue. In pottery a new and harder surfaced grey and buff ware become common, together with an entirely new wheel thrown unburnished ware with purple paint, akin to the Jorwe ware of Maharashtra. An extensive group of rock paintings of horse and riders were common. In his phase the radiocarbon dating is between c. 1400 to 1050 BC.

1.2. Area Under Investigation

Sanganakallu (Lat 15 11', Long. 76 58) is situated 5 km northeast of Bellary, the district headquarters. Sannarachamma hill, Hiregudda, Chaudammagudda constitute a chain of granite hills to the north of the village on top which the archaeological sites are situated (Figure 1.1.1). The Neolithic settlements on the Kupgal hills were first discovered by William Frazer, District Engineer of Bellary sometime before 1872.

Late on Foote visited the sites many times and made prolific collection of tools and other antiquities and concluded this site as Neolithic. The site was visited by many other archaeologists, but it was the late Dr. B. Subbarao who made it is type site for his study of the early cultures of the Bellary region. Sannarachamma hill was excavated earlier (Subbarao 1947, 1948; Ansari and Nagaraja Rao 1969). The excavations here have revealed evidence for phase II and phase III of Allchin and Allchin (1982). In recent investigations were carried out by a team from Karnatak and Cambridge University.

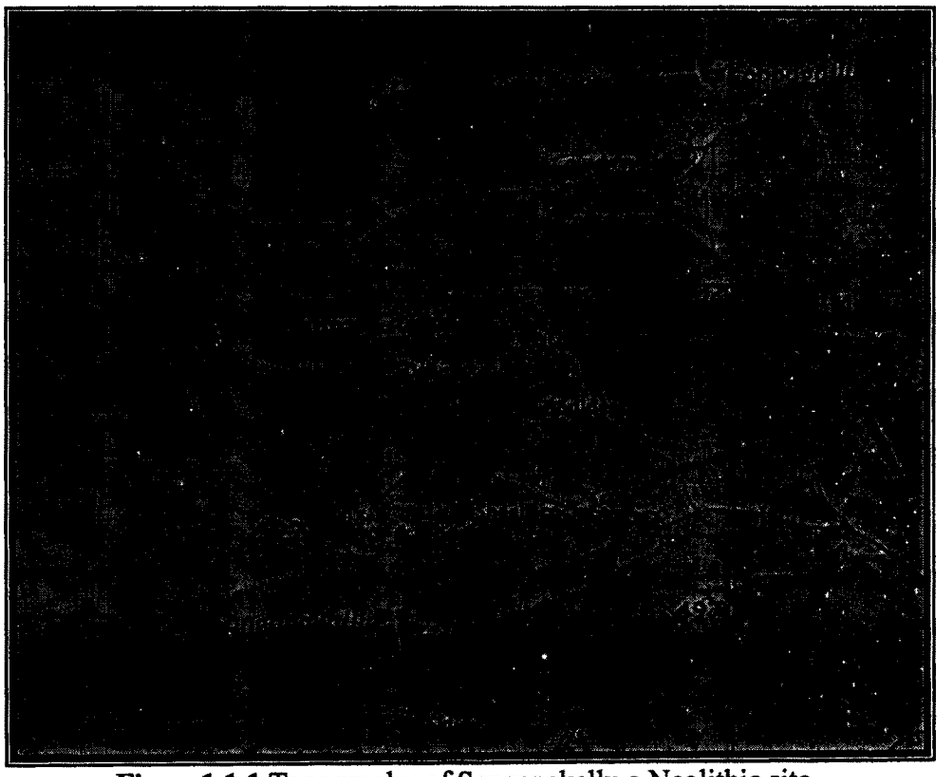


Figure1.1.1 Topography of Sanganakallu a Neolithic site

1.3. Problems

Lithics studies from Holocen period are very rare and they are based on typology. Very little work has been done on locating workshops, sourcing raw materials, and tracing their trade.

In general, few scholars (e.g., R. B Foote 1916; Subbarao 1949; Allchin 1957, 1960; Sankalia 1964) have described the manufacturing process for these lithic assemblages from Holocene period. In general, Foote was able to outline four stages of Neolithic axe fabrication: chipping, pecking, grinding and polishing with the help of the flakes (debitage) found from the site Herigudda (a site from Snagankallu complex). Other than Foote's work no work has been done on the reduction stage, starting from selection of raw material to the finished axe and the manufacturing methods used in making these axes.

The most important and fundamental question on prehistoric lithic research is the processes by which prehistoric flintknappers produced their implements? And why did they produce the forms they did? Whether the lithics obtained from archaeological record represent a intentional end product or do they represent the ongoing process breaking, resharpening or as a discarded objects.

Site related problems

The reports from Sangnakallu give tentative dates of the axe production starting from Neolithic period and the end of these axe production has not been explained any where in these reports. Subbarao (1949) have mentioned about a layer consisting of microlithic artifacts from the bottom most levels and he also mentioned that these microlithis continued throughout the habitation with the neolithic axe production. He never described whether there was any similarity in technology within the pre-Neolithic microlithic industry and the microlithic from the later levels (Neolithic and Chalcolithic).

Foote in his report discuses the Sangankallu site as a Neolithic axe production site, but in his report he never described the quarrying or extraction aspect of the lithics. To understand the relationship between the lithic factory site R.B Foote (1887) and the surrounding habitation sites. All reports of this site have mentioned about the presence of Macrolithis from this site, but no body have described about the processes involved in manufacturing these Macrolithis.

Hardly any work has been done on certain aspects of raw material, including quantity, quality, accessibility, and size and shape which have long been known to influence archaeological lithic assemblages and questions like whether the raw material size and shape

influenced the method of manufacture of these lithic artifacts found in the site of Sanaganakallu.

1.4. Research Methodology:

The research methodologies undertaken for this research work are given below:

Library work

Achievement of the aims outlined above required a large amount of published data to be referred. Library work involves of all available published literature on Neolithic period in the form of research article, monograph, explorations and excavation report, published and unpublished Ph.D. theses in India. Published material relating to geology, chronology, flora and faunal remains, and lithic technology will be referred.

Field survey

The first set of surveys will involve filed-walking. Already explored and excavated sites will be relocated on the site map. Field studies will concentrate on settlement pattern aspects. Geological setting of these sites will be studied. Field survey will enable us to understand land use pattern during the Neolithic times (Holocene).

Site Catchments Analysis

Site Catchments Analysis of major excavated as well as yet to be excavated sites will have to be carried out. This approach will be a key to our understanding of the widespread distribution of Neolithic sites of south India.

Artifact Form and Manufacturing Technological studies

Right from early 19th centaury many scholars like R.B.Foote (1887), H.D.Sankalia (1964), B.Subbarao (1948), F.R. Allchin(1968), Paddayya (1971), David Raju (1985), Venkatasubbaiah (1992),Dorian Q Fuller (1999) and Korisettar (2001) have studied lithic assembelage from the Sothern Neolithic. Here I'm intended to study the lithic assemblage from the study area.

The lithic assemblages from Snagankallu and its surrounding will be taken for analysis. In order to answer the question which are addressed, I have developed a methodology. They are as follows:

Artifact Form

According to the morphological and morphometric attributes and based on the typo-technological aspects, lithics from these sites will be analyzed.

Artifact forms were classed as:

- *Cores*. Cores are further categorized based on the platform namely; single platform multi-platform and core fragment.
- *Formed objects*. Flaked pieces were further categorized based on morphological/ typological divisions of shape and dimensions, as well as initial form and direction(s) of retouch. Most of the flaked forms (pieces) can also be considered as cores rather than discrete types. The classification system used here is based on classification systems devised by R.B. Foote (1916), B. Subbarao (1948), H.D. Sankalia, F.R. Allchin (1957), Lal and Wheeler (1948) and David Raju (1985). These scholars have broadly classified the lithic assemblage of South India based on typology. The types of flaked pieces include:
- Edge tools comprises of axes, adze, wedges, chisel and pick
- Non edge tools comprised of flake and flake tool
- Microithis tools comprised of blades, bladelets, backed blades and cores.
- Macrolithis tools comprised of querns and grinding stone.

Other variables

Stone artifacts were subjected to metrical and non-metrical attribute analysis based on general artifact form in order to quantify

morphological variability. Core, flaked pieces, battered pieces, complete flakes and unmodified pieces were analyzed in detail. Broken flakes, flake pieces and core fragments were grouped by raw material type and by maximum size. Common metrical and non-metrical attribute made on individual artifacts were as follows:-

- Raw material types.
- Percentage of cortex.
- Cortex type: - This will help us to understand the degree of weathering of the natural clasts and selection of the natural clasts for knapping. They are as follows: (1) Angular, (2) Sub-Angular, (3) Sub-Rounded, (4) Rounded, and (5) Indeterminate.
- Cortex location: - The presence of cortex are recorded as (1) Dorsal, (2) Platform, and (3) Both.
- Degree of patination: - Degree of Patination is recorded as (1) Absent, (2) Light, (3) Moderate, and (4) Heavy.
- Degree of edge rounding: - Is recorded as (1) Absent, (2) Light, (3) Moderate, and (4) Heavey.
- Colour of raw material: - Colour of raw material is recorded with the help of Munsell Colour Chart.
- Weight: Measurements were recorded to the nearest gram (gm).

- Maximum dimension: - Measurements were recorded in millimeters (mm) at the maximum dimension of the artifact.
- Maximum width: - Measurements were recorded in millimeters (mm) at the maximum width of the artifact.
- Length: - Measurements were recorded in mm.
- Thickness: - Measurements were recorded in mm.

Measures made on individual artifacts were as follows:

1) *Cores.* In addition to the common metrical and non-metrical attributes many other attributes were taken on individual artifacts they are as follows: scars >15mm, longest face, number of rotations, number of non-feather termination, base thickness, number of elongated parallel scars, platform preparation, platform surface, platform width, platform thickness, last platform angle, number of platform quadrants, measurements (like length, face length, width, and termination type)of four flake scars on the core and direction of flaking (e.g. bidirectional, unidirectional, multidirectional and radial) will be recorded. These variables were selected in order to measure the reduction sequence within the core. It is generally believed that the gradual reduction of cores will result in more flake scars and less cortex % that continued use of a platform will result in decreases in platform size, and that as more mass is struck from a core the size of

the core and resulting flakes might also decrease. If cores are rotated during this process to create fresh platforms once old ones become damaged or unproductive, cores should begin to preserve sings of former sings of former flaking on the platform surfaces as well as indications of the existence of old platform.

2) *Formed objects*. In addition to the common metrical and non-metrical attributes many other attributes were taken on individual artifacts they are as follows: (1) For retouched artifacts: Retouched length, length of margin, length of backing, amount of retouch, retouch angle and retouch thickness is measured at three different places on the specimen, index of invasiveness is measured in degrees as 0.5 and 1 at different place at the margin of individual specimen in order to measure the reduction based on diminishing flake weight, retouch diameter, retouch depth, retouch location, number of retouch segment and typology for retouched specimen. (2) For a notched artifact: number of notches, notch type (simple and complex), notch location, notch width and notch depth. (3) For a burin: number of burin spalls, number of platform, origin of burin blow, number of stepped scars, burin platform type and spall lengths and if these spall are stepped or not. (4) Edge tools (like axe and chisel) were subjected to additional measures (which are discussed later).

3) *Battered and pitted stone.* Common metrical and non-metrical attributes are recorded.

4) *Complete flakes.* In addition to the common metrical and non-metrical attributes many other attributes were taken on individual artifacts they are as follows: proximal width, medial width, distal width, bulb thickness, termination type (feather, hinge, step, outrepasse and crushed), bending, platform width, platform thickness, exterior platform angle, platform surface (single conchoidal, dihedral, multi conchoidal, cortical, crushed and focalized), platform preparation (overhang removal, faceting, both and grinding), dorsal scar count, dorsal scar pattern, number of unidirectional arrises, number of bidirectional arrises, number of radial arrises and edge damage.

5) *Broken flakes, flake pieces and core fragment.* These artifacts forms were grouped by raw material and maximum dimension. Proximal flakes had platform thickness, platform width, platform surface, platform preparation and exterior platform angle measured. Medial and distal flake fragments, flake pieces, and core fragment were not measured individually.

6) *Unmodified pieces.* Common metrical and non-metrical attributes are recorded.

Description of metrical and non-metrical attributes:

Linear measurements of stone tool were taken using electronic digital calipers (accurate to 0.1mm), weights were measured by using pocket scale PS-200B for small artifacts (accurate to 0.1 gm) and Satrue-SWL-5 for big artifacts (accurate to 0.5gm). Edge angle were determined using a goniometer.

Additional attributes for shape/morphological measures of large cutting tools were taken according to the system developed by Roe (1964).

- L1 = Distance from the base of the LCT to the point of maximum width
- B1 = Width of the tip at 1/5 of length down from the tip (tip width).
- B2 = Width of the base at 1/5 of length up from the base (base width).
- Th1= Thickness of the tip at 1/5 of length down from the tip (tip thickness).
- Th2= Thickness of the base at 1/5 of length up from the base (base thickness).

The additional measurements taken for large cutting tools are then used to generate indices. They are as follows:-

- B1/B2 would assess the width of the tip relative to the width of the base.
- B/L would show us how wide the artifact is in relation to its length.
- Shape Index: B/L. Roe (1964)
- Shape Index: B1/B2. Roe (1964)

Additional measurements for ascertaining the morphology of edge tools were taken they are as follows:-

Initial form

Initial form refers to the initial point form which the flaked piece was made. Initial form categories includes pebble, cobble, slab, blocky, flake, and indeterminate. Pebble, cobble, and slab were identified by the presence of cortex on the artifact. Flakes were identified by the presence of one or more attributes, including presence of platform, bulb of percussion, flake release surface, and ripples on the convex ventral surface.

Measurement of Invasiveness (in %)

This is a variable used on edge tools. Individual artifact has two sides (Side1 and Side2). Side1 was divided into two segments vertically namely Edge1 and Edge2, further these two edges were sub- divided into eight smaller segments horizontally each Edge having four divisions equally (namely Edge 1 had four subdivisions namely Edge1of

1, Edge 1 of 3, Edge1of 5, and Edge1of 7 and Edge 2 had four subdivisions namely Edge2of 2, Edge2of 4, Edge2of 4, and Edge2of 8). Side 2 was divided in the same manner as we have seen above. The invasiveness was estimated in each of the above said subdivisions using discrete categories (0%, 25%, 50%, 75%, and 100%). This would tell us about the various reduction stages involved during axe manufacture. A high % of invasiveness would tell us that, minimum no. of flakes has been removed from a particular specimen and this will in turn tell us about the different stages.

Measurement of Pecking, Grinding and Polish

This is a variable used on edge tools. Individual artifact has two sides (Side1 and Side2). Side1 was divided into three segments horizontally namely proximal end, medial, and distal end, this will help me to understand the last stage of manufacture of axe and whether there were any patterns which they preferred.

Cortical surface

Percentage of cortex remaining on flaked pieces was estimated in percent (%) and was recorded as 0%, 10%, 20%, 30%, 40%, 50%, 60%, 70%, 80%, 90%, and 100% respectively. This category can provide a qualitative measure of the intensity of flaking.

Exterior platform angle (EPA)

This variable measures the exterior platform angle of the complete flakes. Only one measure was taken on each specimen. Higher exterior platform will result in thicker and heavier flakes (early reduction flakes) and low platform will result in thinner and slender flakes (later stage of reduction flakes)

Measurement of Invasiveness of a retouched artifact made from a complete flake, broken flake, and flake piece

The measurement of invasiveness of a retouched artifact which allows fast and accurate calculation of flake scar coverage for both (dorsal and ventral) surfaces of an artifact. An artifact is first theoretically sub-divided into eight analytical segments on both its dorsal and ventral surfaces, giving a total of 16 segments to an artifact. Further these sub-divisions are made such that each segment represents one-fifth (20%) of the total length of the artifact. The artifact's surface is then further divided into two zones for each segment, an outer zone and an inner zone. For the inner six segments (segments '2–7' and '10–15'), invasiveness zones are partitioned at the halfway point between the middle and the lateral margin of the artefact. For the proximal and distal segments (segments '1', '8', '9' and '16'), the marginal/invasive

boundary is located halfway between the distal or proximal margin of the flake and the outer edge of the inner six segments.

The thesis is divided into seven chapters as follows:

1. Chapter I is brief introduction of Neolithic culture, Previous investigation in south India, area under investigation done by earlier scholars, and also describes the problems and methodology adopted in the present study.
2. Chapter II is gives a descriptive account of the geographical background of south India, physical features, geology and soil River system and climate and Rainfall.
3. Chapter III is describing southern Neolithic cultures in India, site from southern neolithic, features of southern neolithic, ashmound tradition, problem of ashmound, a comparative study of southern neolithic sites to neolithic sites from other parts of India.
4. Chapter IV is deals with the study of cultural remains in order to reconstruct settlement and subsistence patterns of southern neolithic sites, archaeological remains and biological remains.
5. Chapter V is deals with the stone tools from southern neolithic, a brief account on the study of stone tools from southern neolithic period, edge tools, non edge tools, microiths and marcoliths.

6. Chapter VI is deals with the stone tool assemblages from Sangankallu, raw material study, location and description of raw material, site-to-source distance, shape of natural clasts, properties of raw material. Stone tools assemblage from Snaganakallu. Types of stone tools from Sanganakallu. Morphological variability within this lithic assemblage.
7. Chapter VII Conclusion.

Geographical background

2.1. Physical features

The peninsula of India taken in its broadest sense is distinct from the alluvial plains of Indus and Ganga in being composed of ancient rocks forming hills and the peninsular India refers to that region south of the Narmada river running along the western side of the peninsula are hills known as the Western Ghats, that appears as high sharp 'steps' above the western coastal plain (Figure 2.1.1).The Sahyadris as they are known reach elevations of over 1000 meters in Maharashtra between the Tapti river and the source of the Krishna and mostly have lower elevations in Karnataka. Further south, they become higher, culminating in the high elevations of the Nilgiri hills south of Mysore city.

The Bellary District is located in the centre of the Deccan Plateau, between latitudes 15^0-58' and 14^0-80' N and longitudes 75^0-43' E and 77^0-45' E. The western and the northern boundaries are formed by the river Tungabhadra, which separates it from the Bombay Presidency in the west and H.E.H. Nizam's Dominions in the north. In the south, it is bounded by Karnataka state. To the east is the Kurnool district of the Madras Presidency.

This small district consists of two widely differing natural divisions, an eastern and a western separated by the Sandur hill range

which runs right across the district for more than thirty miles in a north westerly direction, corresponding approximately to the two linguistic zones which comprise the district. The eastern division comprises the taluks of Adoni, Alur, Siruguppa, part of Hospet, Bellary and Rayadrug. These are almost treeless tracts, and mostly black cotton soil with characteristic outcrops of granatold hills like "islands out of the sea" overlooking the surrounding fields. The western zone consisting of parts of Hospet, Harapanahalli, Hadgalli and Kudligi taluks contains patches of black cotton soil and is broken up by constant successions of wild rugged hills (mostly of Schistose Dharwar type).

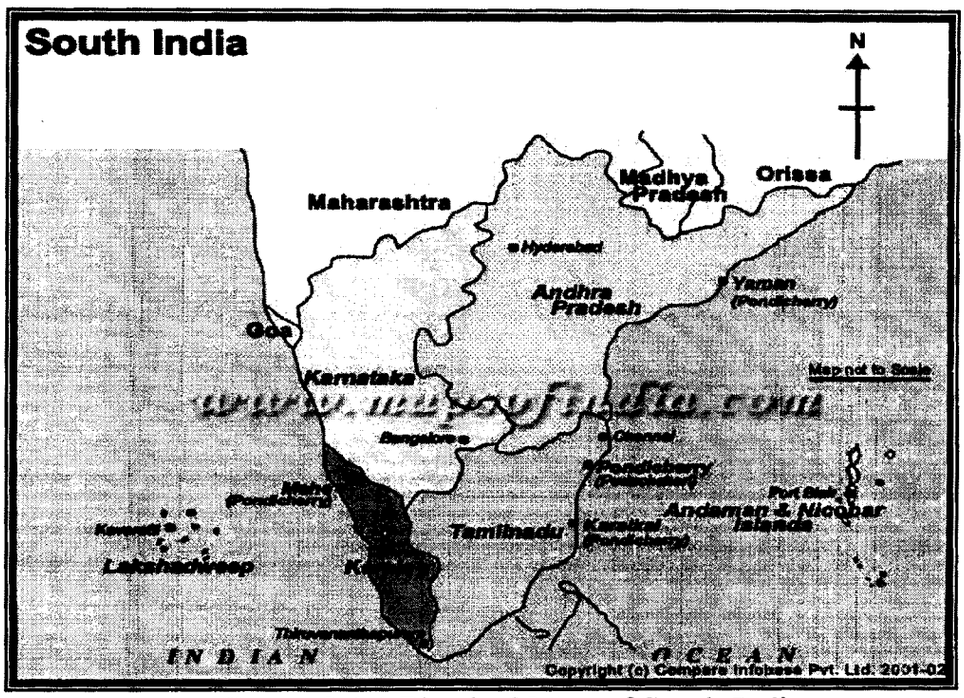


Figure 2.1.1 Physical Map of South India

Orography

The Sandur hills occupying the native state of that name in the centre of the District are the most noticeable physical feature of the District. The range touches the river Tungabhadra at Mullapuram and runs south-eastwards for about 30 miles and joins the Kudligi-Rayadrug group of hills.

The other important range of hills is the 'Copper Mountain', which runs parallel to the Sandur range about six miles east of it, for a length of about 236 miles from Daroji in the Hospet Taluk to within four miles of the river Hagari. The most important range of hills is Mallappangudda range which runs about 30 miles west of Sandur hills in a S.E. direction for a length of nearly 25 miles in the District and crosses into the Karnataka state. For the rest the hills are found either in clusters or isolated throughout the District.

1. The most important of the groups of hills is the Adoni group running in south-easterly direction form Kosgi to the town of Adoni and little beyond as far as Emmiganur. This group contains the prehistoric and settlements at Adoni, Kotakallu, Gudekallu and Kosgi.
2. The second important group is the Alur group commencing form the confluence of the river Tungabhadra and Hagari and running in

a south-easterly direction as far as Chippigiri and Guntakal. This group harbour the prehistoric and protohistoric sites of Halekota, Kanchagara Belagallu, Holalgondi, Hosapetadevaragudda, Hattibalagallu, Ramdurgam, Arikere, Chippigir and Guntakal .

3. The third important group is the Rayadrug group which is really an extension of the Gudekota hills to the west running right across the tongue of Mysore territory which separates the Rayadrug and Kudligi taluka of the Bellary District. This group is cut into by the river Chinna Hagari, tributary of Hagari. Thus till small river valley accounts for the following sites: Hosahalli, Gudekallu, Brahmagiri, Siddapur, Jatingarameshwar, Mullapuram and Sadam. Other sites located in the same group of hills are: Rayadrug, Gallapalli and Addaguppa.
4. The last group of hills is Harapanhalli Uchchangidruga group of hills in the Harapanahalli taluk. In this group are located a number of minor sites.

Among the isolated hills, the most important are the two hills in the term of Bellary: the 'Fort Hill' and 'North Hill'. About three miles to the north-east is the famous group of 4 hills; Sannarachamma, Sadasiva, Chaudamma and Herigudda ('Kupgal' hill), and around which the important prehistoric settlements of Sanganakallu and Kupgal are

located. This whole group indeed constitutes the two arms of a horseshoe shaped valley (valley of Sanganakallu).

These hills of the Bellary District combined with their favourable geological features, have contributed not a little to its cultural evolution. The hills served as abodes of pre- and proto-historic man and the intrusive trap dykes supplied raw material for his tools.

2.2. Geology and Soils

The peninsula of India is a large block of various igneous and metamorphic rocks broadly divisible into two regions

A northern and western one in which the Cretaceous Deccan Trap volcanic rocks dominate as bedrock and

The more southern and eastern one dominated by Archaean granites and gneisses.

The boundary between these geological regions lies in northern Karnataka in the Bijapur and Gulbarga districts, and runs north-south nearly on the western boundary of the state of Andhra Pradesh. On these Deccan Traps, deep black soils (known as "black cotton soil" or "regurs") which are highly fertile have developed. These soils also occur in the granitic zone along the courses of the Bhima, Krishna and Tungabhadra rivers, thus covering much of the Raichur and Shorapur doabs. The black colouration is mostly due to the moisture retaining

nature of the soil and making it available to plants long after rains have stopped. The property of black soils of expanding and contracting to an unusual degree results in the thorough mixing of the soil vertically. The montmorillonitic nature of soil causes moisture retention and in turn causes it to be of a darker colour. The palaeo black soils formed due to the erosion of the Deccan Trap are transported by rivers like the Krishna and Tungabhadra and are deposited. Thus the deposited black soils are shallow when compared to the deep deposits of the Deccan Trap area.

The granitic terrain, which includes the Bellary, Anantapur and western Kurnool districts, is largely covered by lighter black soil (vertisols) mixed with red, sandy soils that form around the granite hills. The granitic super-region is criss-crossed by dykes of intrusive dolerite rocks, which served as the raw material source for the Neolithic ground stone industry.

The northwestern portion of the southern region (focusing on the Dharwad district) consists of greenstone formations (Dharwar schists, metavolcanics, etc.). The upper Tungabhadra, flows through this terrain. Light reddish loamy soils form on this geology, although this represents a narrow strip of soil bordered on the west by the laterite of the Western Ghats. The Dharwar schists contain exploitable deposits of iron.

Other schist belts in Karnataka contain deposits of gold, such as the Hutti-Maski Belt which extends through the western Raichur Doab and the Shorapur Doab, and the Kolar schist band in southeastern Karnataka. Ancient mining sites exist along the Hutti-Maski beds in the same general areas as Neolithic sites, suggesting that exploitation may date back to the Neolithic times.

The geological history of Karnataka is mainly confined to the two oldest eras; the Archaean and the Proterozoic. The later periods of the geological timescale from the Cambrian onwards are not represented in the geological history of Karnataka apart from some minor deposits of recent age in the Western Coast and the Deccan Trap. A large part of North Karnataka is covered by the Deccan Trap, the basaltic lava from the volcanic lava from the Cenozoic era.

According to Radhakrishnan and Vaidyanadhan (1997), there are four main types of geological formations in Karnataka:

The Archean complex made up of Dharwad schists and granitic gneisses: These cover around 60% of the area of the state and consist of gneisses, granites and charnockite rocks. Older Gneiss Complex is the basement for a widespread belt of schists.A younger group of gneissic rocks mostly of granodioritic and granitic composition is found in the eastern parts of the State. The next in the order of age are the schist belts

first the auriferous and then the Dharwar schists. The narrow belt of younger closepet granites mark the end of the Archaean era. Some of the minerals found in this region are dolomite, limestone, gabbro, quartzite, pyroxenite, manganese and iron ores and metabasalt.

The Proterozoic non-fossiliferous sedimentary formations of the Kaladgi and Bhima series: The Kaladgi series has horizontal rocks that run for 160 km in the districts of Belgaum, Raichur, Dharwad and Bijapur districts. The Bhima series that is present on either side of the Bhima River consists of rocks containing sandstone, limestone and shale and this is present in the Gulbarga and Bijapur districts.

The Deccan Trappean and Intertrappean deposits: This is a part of the Deccan traps which were formed by the accumulation of basaltic lava. This is made up of greyish to black augite-basalt.

The Tertiary and Recent Laterites and Alluvial deposits: Laterite capping are found over the Deccan Traps and were formed after the cessation of volcanic activity in the early tertiary period. These are found in many districts in the Deccan plateau and also in the coast.

The area of interest in this work lies in the heart of the Deccan Penninsula and the geology of the Bellary-Raichur is of much importance. This region like most parts of the Deccan Plateau has a basement of the Archaean Gneiss complex mostly of the Younger

Gneissic Complex with a composition of granodiorites and granites. These Gneisses are dated to 3.0 2.6 b.y and encloses the auriferous schist belts. There are four narrow auriferous schist belts, namely, Hutti-Maski Schist Belt, Mangalore Schist Belt, Hungund-Kushtagi Schist Belt and the Deodurg-Raichur Schist Belt. The metasediments in these schist belts include minor cherts, banded iron-formation, garnet-bearing rocks and biotite-schist. The gold mineralization in these belts has resulted in many ancient gold workings throughout the area. The belts are intruded by the younger granites. The Sandur basin in the region belongs to the schist belts of the Dharwar type and is characterised by manganiferous greywacke, phyllite and numerous bands of banded magnetite and haematite quartzite (banded iron formation). The basin is known for its rich accumulation of both iron and manganese ore. Like the Auriferous Schist Belts, the Sandur Basin also has intrusive younger granites.

A striking feature in the geological map of Karnataka is the occurrence of a long linear belt of granite extending in a N-S direction for nearly 500 km and keeping an average width of about 20 km. The linear aspect of the belt extends from Kabbal in the south to Bellary in the north for about 300 km and the granites spread out over a wider region north of Bellary. These granites lie between the Archaean

nucleus in the west and a younger remobilized and reactivated block of the Purana basins belonging to the Proterozoic era to the east. The granites generally form high hills and are abruptly demarcated from the sorrounding gneissic plains. These lofty masses of granite with their characteristic weathering into spherical boulders of immense size, bare of vegetation, form some of the most picturesque hill masses of Karnataka. Physiographically, there is a clear-cut demarcation of the granite belt, the younger granite forming a hilly rugged country, in contrast to the featureless plains formed of the older gneisses. These younger granites hold the Sandur Schist Belt as an enclave, surrounding it on all sides.

The most characteristic rock type of these Younger Granites is the coarse-grained porphyritic granite with tabular and prismatic crystals of K-feldspar. These granites are the youngest intrusive in the Archaean complex of Karnataka with an age of around 2600 m.y. Coarse porphyritic grey and pink granites occur as oval to circular plutons and the rock is rudely foliated.

Towards the north of the Younger Granites consisting of the modern districts of Belgaum, Bijapur, Bagalkot, Gulbarga are the Purana Basins of Kaladgi and Bhima of the Proterozoic Era. Orthoquartzite (quartzitic sandstone), argillite (shale and mudstone) and

carbonates (including dolomite and limestone) are the principal sediments comprising the Kaladgi sequence. Conglomerates of cobble-sized quartzite, vein quartz and cherts, fragments of jasper and chert breccia are also found in plenty in the Kaladgi Basin. Parts of north and west of the Kaladgi Basins are covered by the Deccan Traps. The Bhima Basin extends over the modern districts of Bagalkot and Gulbarga Districts of Karnataka. The lithology of the region consists of shales, limestone, and sandstone and quartz conglomerates. The end of Archaean era saw dyke activity and thus the Purana Basins do not consist of any dykes. Dolerite dykes are abundant in the areas belonging to the Younger Gneissic Complex mainly the Closepet Granites.

2.3. River system

The gradual eastward slope of the interior plateau that extends to the east of the Western Ghats has resulted in the eastward drainage of all major rivers.The three largest drainage systems are the Godavari, Krishna and Kaveri. The Bhima, Tungabhadra, Malaprabha, Ghataprabha, etc. are the other major tributary streams. To the east of this, the eastern half of the peninsular south of the lower Krishna watershed is the Pennar River, including the Kunderu River as a tributary from the north.

The areas of land between the confluences of two major, roughly parallel rivers, is often referred to as a Doab, notably the Shorapur Doab west of where the Bhima joins the Krishna, and the Raichur Doab where the Tungabhadra joins the Krishna. The plateau area south of the Raichur Doab and Tungabhadra River is sometimes referred to as the Rayalaseema (the territory of the medieval Rayas of Vijayanagara).

The river Tungabhadra and its tributary Hagari form the principal drainage system of the Bellary District. Only a small portion of Adoni and Alur talukas in north-east and in the south-east drain into the River Pennar.

The river Tungabhadra, which acts as the boundary of the District for nearly 207 miles in the north and west, falls into the river Krishna in the Kurnool District. It enters the district in the south-western corner and flows between the high banks of red loam at a point 1730 feet above mean sea level. When it leaves the District it flows about 1000 feet above mean sea level accounting for a fall of nearly 730 feet in 200 miles.

Its chief tributary is Hagari which is joined by Chinna Hagari (from the Molkalmarru Taluk of Karnataka state) in the Rayadrug Taluk. It flows due north in a wide shallow sandy bed and joins the river Tungabhadra north of Siruguppa.

There is another small tributary called Chikka Hagari which flows through the Harapanahalli and Hadgalli taluks. There are a number of minor streams which fall into the river Tungabhadra.

2.4. Climate and Vegetation

The Indian Ocean monsoon system not only greatly influences the seasonality and climate in India but also ties together South Asia with other regions bordering the Indian Ocean such as East Africa and the southern Arabian Peninsula. The monsoon, together with patterns of sunlight and temperature, results in three seasons in most of India: the wet season (monsoon), roughly from June to mid-December, the 'cool' season from mid-December through February, and the hot dry season from March to the end of May/early June until the rains start. The wet season is further divisible into that of the advancing and retreating monsoons. The main monsoon advances from the southwest. During the late wet season/early cool season (October to December), the wind direction reverses towards the southeast. This is known as the retreating monsoon. This brings some additional rainfall, but the only large quantities come off the Bay of Bengal onto the southeast coast, especially Tamil Nadu and to a lesser extent southeastern Andhra Pradesh. Some rain also comes off from the Himalayas onto the northwestern subcontinent during this period.

The Southwest Monsoon strikes first in early June (maximum in July or early August) the Malabar Coast and the Western Ghats, which receives high quantities of rainfall, creating tropical evergreen forest conditions, whereas on the eastern side an extensive rain shadow area exists. It is in this rain shadow, east of the Western Ghats that the semi-arid savanna lands occur. This rain shadow effect is more pronounced towards the southern Deccan, e.g. Karnataka. The regional rainfall minima occur in the region around Bellary, where rainfall may not exceed 60 cm per annum. The driest region of the peninsula is that centered around Bellary (classified as sub-desertic with tropical tendencies, with a dry season of nine months), while the adjacent Chitradurga region to the south is somewhat wetter (Tropical Medium Dry, 5-6 month dry season), and the areas to the north, including Kurnool, Raichur and Shorapur are Tropical Accentuated Dry, with a 7-8 month dry season.

The eastward drop in rainfall, rising again east of the Bellary District, means that the peninsula of India (the northern and southern Deccan) can be divided into roughly north-south strips of rainfall zones, corresponding generally to vegetation zones.

The Bellary zone is essentially a dry zone, located as it is in the heart of the Deccan being closer to the high Western Ghats and so far

inland from the East coast. At present it is a dry tract with a rainfall of less than 25 inches per annum. Even in late prehistoric times, the climate could not have been much different, except in the Pleistocene when "the southerly latitudes of India had a succession of cold pluvial epochs." In recent times, "a change in the prevailing winds is impossible so long as the present distribution of water exists." But there is evidence even in very recent times of the effects of reckless deforestation, which accounts for the present conditions. Probably as in the historic period, the Sandur and other major hill ranges in the District would have been covered with greater forests. This would have slightly improved the rainfall. Even today in the western half of the District on the other side of Sandur hills, there is "a slightly heavier but light rain fall than the eastern zone."

The flora brings out the contrast between the two zones. In the drier Eastern zone, the flora consists of such draught resisting plants as Euphor Bias, Asclapidas an Acacia Arabica, while the western zone shows a damper flora.

The region is characterized by dry heat. The temperature has a diurnal range. The cold nights and the burning mid-days have contributed to the peculiar rock weathering and fracture which is noticeable in the granatoid hills of the District

Southern Neolithic Cultures in India

The first discoveries of ground stone implements in India are more than a century old. Captain New Bold's discovery of ash mounds at Kudatini and Kupgal in 1836, and William Fraser's discovery of Neolithic settlements at 'North ill' of Bellary town and Kupgal near sanganakallu have created an inquisitiveness in Robert Bruce Foote, who after 1885 discovered nearly 200 Neolithic sites in Deccan and South India. The notable work of Foots fall in the districts of Hydrabad, Mahabubnagar, Kurnool, Cuddapah, Anantpur and Guntur of Andhra Pradesh, Richur, Chitradurga, and Bellary of Karnataka, North Arcot, Salem, Tiruchinapalli and Dharmapuri in Tamilnadu. Since Foote's work in many parts of the country particularly in Deccan and south India, Ground stone implements were collected in large quantities. But it was not until 1947 that the conscious attempt was made to determine the chronological and cultural contents of the ground stone industries. Wheeler's excavations at Brahmagiri (1948: 181-310) have placed the Neolithic industries of the Deccan in a chronological perspective.

Wheeler's excavation of Brahmagiri provided the necessary stimulus, where after, Neolithic sites one after the other was excavated in quick succession in different parts of South India. Such of the excavated sites include Sanganakallu (Subba Rao, B: 1948; Ansari, Z.D.

and Nagaraja Rao, N.S. 1969); Nagarjunakonda (soundarajan, 1958; 48-113, R. Subrahmanyam at. Al. 1975); Piklihal (Allchin, F.R.1960); Utnur (Allchin, F.R.1961), Maski (Thapar, B.K.1975: 4-142); Kesarapalle (Ferkar, H.1962); T.Narsipur (Seshadri, M.1971), Veerpuram (Sastry, T.V.G. et. al. 1984); Dalamalai and Totarapalli (Narasimhaih, B. 1980) etc. The evidence furnished by these exactions has gone a long way to add to our knowledge of the life and times of Neolithic in South India.

Regarding the origin of Neolithic in India, Wheeler contended that it holds origins to South-East Asian and Chinese influences. The remarkable view was given support by a similar contention of Worman. Wheeler (1949) stressed on the East Asiatic Origin to India Neolithic. Dani (1960) demonstrated that the Indian Neolithic did not belong to a unitary cultural complex. He made it amply clear that at least two strains went into the make up of the India Neolithic phase. Krishnaswamy (1960:125-64) rightly stressed on the recognition of several cultural zones in trying to prepare a distribution pattern for the India Neolithic. Allchin, F.R. (1960:127), however, believes in South Indian Neolithic cultures characterized by pointed butt axes and grey pottery may have had origins traceable to the Neolithic and Chalocolithic Cultures of West Asia. But Allchin does not enlighten us the route followed by the

influence to spread. We do not get continuity in the geographical distribution of pointed but axes in the wide area aspirating Deccan from the Indo-Iranian border lands (Sankalia, H.D.1964 271-72). Discounting the land route, the alternative would be to think in terms of sea route across the Arabian Sea. If sea route is to be followed we should expect in India as exact replica for one or the other of the Neolithic cultures of West Asia. But such has not been documented on archaeological record. On the other hand, if the land route were followed, the Neolithic Cultures of the Deccan should have been transmitted by the Indus or post-Indus traditions. But not many Harappan influences are to be found in the cultural make up of the South Indian Neolithic (Sankalia, H.D.1974: 271-72). Somewhere we discount extra-Indian original for the Neolithic of South India, we have to provide satisfactory proofs for independent origins of farming either in Deccan or South India. Thaper, B.K. (1965) of the opinion that Southern Neolithic originated in the region itself. According to him, Neolithic blade industry is derived from pure microlithic series. He also wishes to find out "Whether there was any continuation series into the southern Neolithic complex". In this content, Sundara's (1983) recent theory is worth nothing. According to that theory, Sundara tried to find out aceramic meolithic stage similar to that of West Asia.

As Shevrory hills in Tamilnadu, and Maski and Sanganakallu in Karnataka witnessed Early Neolithic stage characterized by coarse gritty pottery, limited number of ground stone axes with microlithic tools from Nagarjunkonda in lower Krishna Valley and Deilmalai, and Togerapalli in the upper Kavery Valley. According to him the mature Neolithic stage was developed at Krishna-Tungabhadra doab because of the fusion of Deccan Chalcolithic cultural traditions into the aceramic and early Neolithic traditions. This stage he attributed to mature Neolithic found at Nararguna konda (Phase II) or the sites similar in nature elsewhere. Though this theory is appearing, it is still at a hypothetical stage and needs much survey and digging. In spite of all these theories we have to confess that we know very little about the beginnings of agriculture in the Deccan and South India.

3.1. Site from Southern Neolithic

Studies in the southern Neolithic culture from 1821 and 1916, nearly 300 southern Neolithic sites were reported from different sectors of South India (Krishna 1931; Munn, 1934; Foote 1916). Neolithic research gained momentum again in the 1940s. Several important and significant excavations were carried out during the second half of the 20th century (Subbarao, 1948; Wheeler, 1947-48; Thapar, 1957; Allchin, 1960, 1961; Rami Reddy, 1978; Paddayya, 1993a and 1993b;

Seshadri, 1971; Nagaraja Rao and Malhotra, 1965; Nagaraja Rao, 1984; Hanumantha Rao and Nagaraju, 1974). Continuing survey and systematic documentation of material culture sites have now realized in a listing of more than 800 Neolithic sites in the four southern states of Andhra Pradesh, Karnataka, Tamil Nadu and Maharashtra (Korisettar et.al. 2002). Andhra Pradesh records the highest number of sites and Tamil Nadu, the least. The Rayalaseema (Parts of South-west Andhra Pradesh and mid-east Karnataka) and the western parts of the former Nizam's dominion constitute the core area of ashmound tradition of early Neolithic culture of South India. These three states constitute the southern Neolithic Province and the Rayalaseema represents the hub of its development. The earliest stages of Neolithic culture are well represented by the excavated sites in the latter region. Evidence from the coastal states of Goa and Kerala as well as the coastal districts of Karnataka and Maharashtra is however scanty and scattered.

A general picture of cultural development of the period from early 3rd millennium B.C. to 1st millennium B.C. has been reconstructed based on the excavations of select sites in the each of these states (Allchin and Allchin, 1982; Murthy, 1989).

Here, I have selected Sanganakallu a important Neolithic excavated and well dated site as a core area and its surrounding sites,

within 50 km radius as peripheral area that include the sites of Brahmagiri and Palavoy which are also excavated.

Brahmagiri

Brahmagiri site is found in the granitic region, rising some 600 feet above the plain, within the Molakalmuru Taluk of the Chitaldurg (Chitradurga) District in the northern extreme of Karnataka State. The Brahmagiri excavations revealed a continuous occupation from the Upper Neolithic through the Early Historic (Figure 3.1.1).

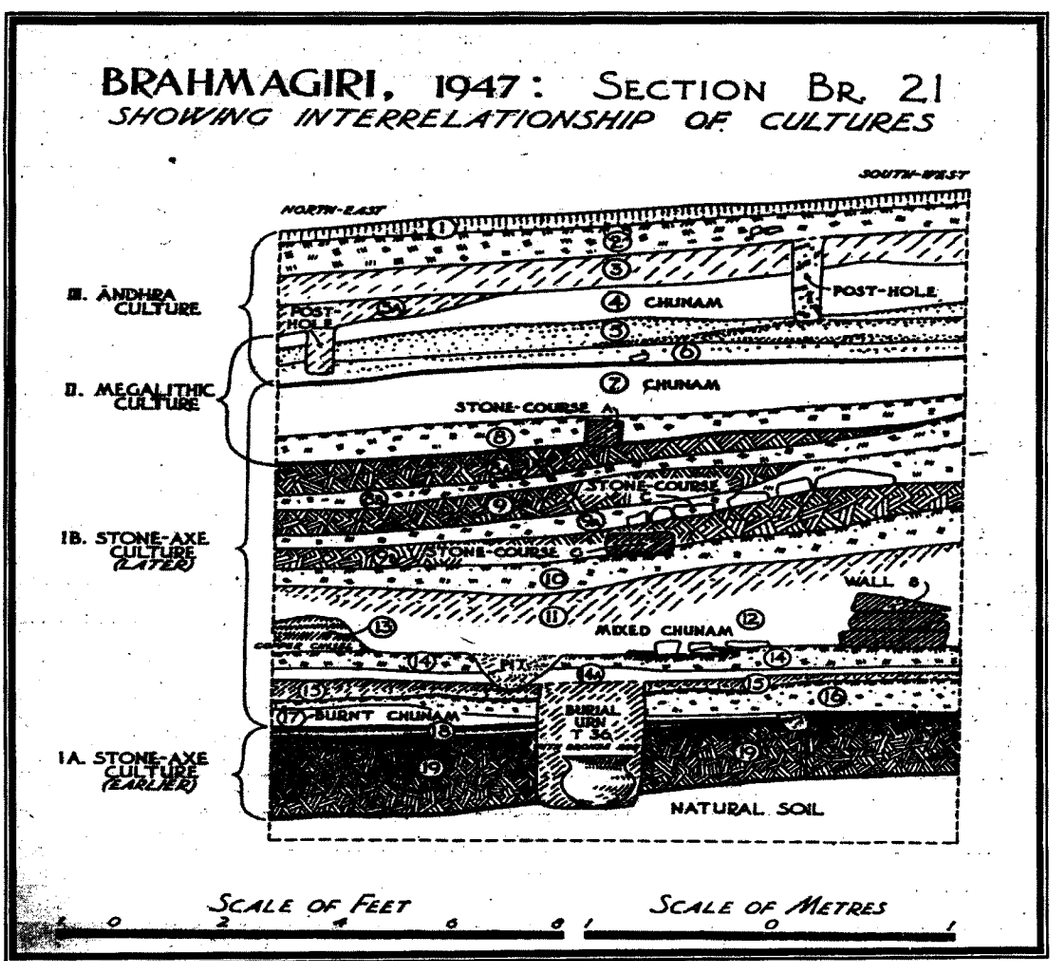


Fig.3.1.1 Stratigraphic of Brahmagiri

The upper levels designated as the Andhra Culture included Rouletted Ware in association with red pottery decorated with criss-cross yellow paintings. Below this was the Megalithic phase characterized by cist-burials, well polished Red and Black Ware and Red Slipped Ware. Beneath the Megalithic phase was the deep stratified deposit of stone axes, burials in crude handmade urns, microliths of quartz, agate, and occasional copper and bronze objects. He also observed an "overlap" between Megalithic and Early Historic phases (Fig.3.1. stratigraphic). In addition there was overlap between Neolithic pottery types and "Megalithic" pottery types, although Wheeler downplayed this fact, in part because of his belief that the megalithic burial tradition must have been introduced by immigrant-invaders (Wheeler 1948: 203; 1959: 164-7). This excavation provided a relative chronological sequence of "cultures," although Wheeler had to rely on guesswork for assigning absolute dates. He only allowed a very limited time span of one millennium for the development of these cultures. The Neolithic culture was dated to the early part of the first millennium B.C. with the megalithic beginning in the third century B.C., his immigrant culture driven south as part of the historical expansion of the Mauryan empire, transformed into the Andhra Culture in the beginning of fist century A.D. Subsequent work and radiometric dating were to seriously revise these dates. Despite his mistakes, Wheeler's chrono-startigraphic

approach to excavation provided inspiration to the coming generations of archaeologists, who pursued similar excavation programs on a number of southern prehistoric sites from the late 1950's through the 1970's.

The lithic finds from Brahmagiri are mainly confined to Period I. the microlithic industry is crude in the extreme and rarely exhibits any attempt at retouching. While there is a crescent, but, there are no lunates, trapezes or scrapers, in contact to the Mesolithic industries. The majority of the tools are double-edged blades in jasper without retouch, a few of which have serration on one edge. Finished microliths to the extent of ten percent were recovered from Sub-period I A, while 90 percent were recovered from Sub-period I B. The technique of the serration, though known from the earliest level of the site, was not widely applied. The serrated blade shows no sign of gloss on the serrated or unserrated edges and is restricted to the lower level of Sub-period I B. There is also a crested-ridge flake. The exact character of Brahmagiri microlithic industry is hard to determine, as fluted cores, corresponding to the parallel-sided blades, are absent.

Of the stone axes of the pointed-butt type (Figure 3.1.2), fifteen complete and twenty-nine broken specimens were found in Period I, in various stages of chipping, pecking, grinding and polishing. The

majority of the axes were obtained from the lower levels, with a unique stone adze from the higher levels of Sub-period I B. Again, the axes fall into two groups, one with flattened lenticular section, restricted the lower levels, and the other with ovoid section, present throughout the Period. The other lithic tools in this Period are saddle-querns, rubbers and spheroid balls.

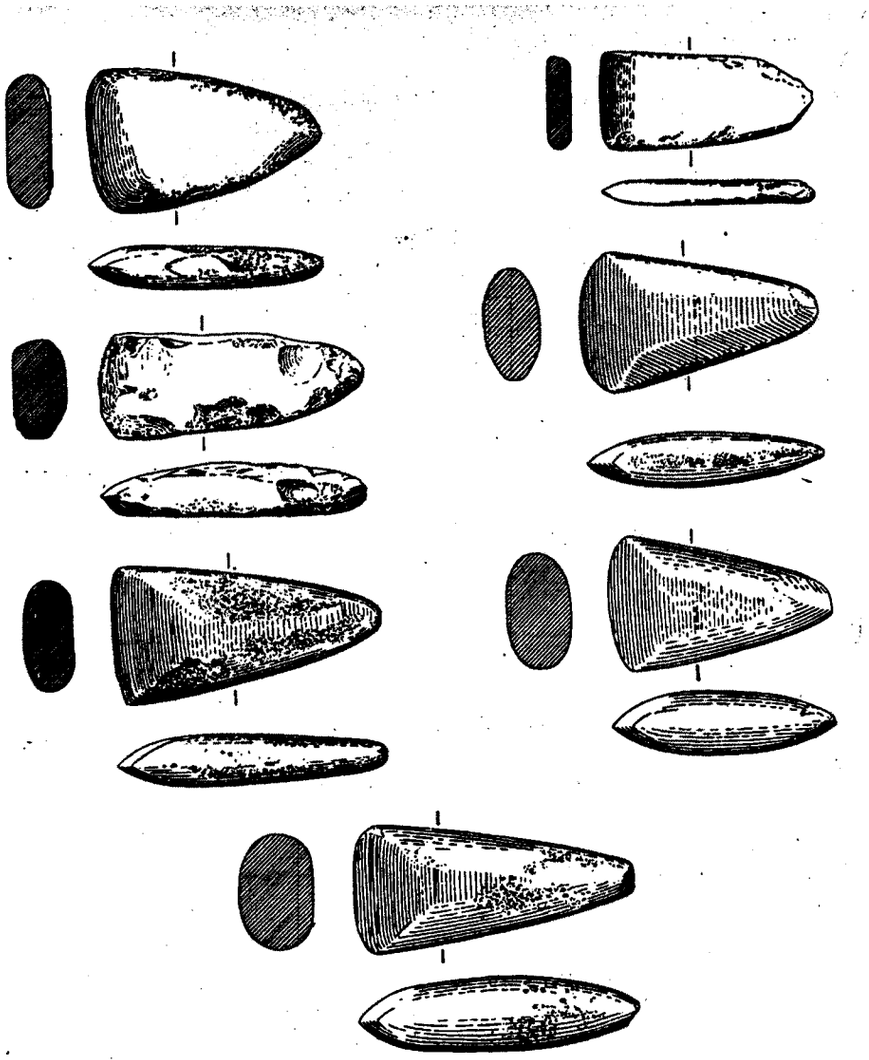


Fig.3.1.2 Types of Stone Axe: Brahmagiri

Pottery was all handmade, crude, coarse fabric with a thin slip of clay. It was grouped into two broad wares 1A and 1B. The 1B ware was

confined to urns-burial, of mottled grey colour, with a coarse texture a conspicuous micaceous inclusions in ware 1A there are two categories, (a) painted pottery and (b) incised pottery. The painted pottery had either a red or buff slip. The red slipped pottery was burnished and salt-glazed. The painted decoration, when present, was applied after firing with ochre. The incised pottery bears designs of a herring-bone or criss-cross patterns. The painted pottery has two varieties (a) red burnished slipped ware with purple painted designs and (b) red, burnished slipped ware with purple paint and unburnished buff slipped ware. Although Wheeler argued strongly that the Neolithic represented a distinct people from the subsequent "megalithic people", the ceramic sequence at Brahmangiri in fact shows the indistinctness of his "Megalithic" horizon, since the earliest levels with Megalithic also contain his Neolithic types and the later megalithic levels incorporate "Early Historic" types, thus suggesting an evolutionary sequence of ceramic technology and style.

Palavoy

The village of Palavoy (140 39' Lat. 770 12' E. Lon.) is about eight kilometers to southeast of Kalyandurg town from right on the southern side of Kalyandurg – Dharmavaram road in Anantapur district

of Andhra Pradesh and is about 40 kilometers south of Bellary – Sanganakallu complex of sites.

Geologically the site of Palavoy is situated in the archaean complex. The principal rock types belonging to Dharwarian age consist of dolerite schists, gueise, gneise, amphibolite and epidiorites. Environmental setting of the site is Savanna environment.

In the excavations a sequence of 14 layers was found. These could be divided into three cultural periods, namely Palavoy I, II, and III. Palavoy I was designated as pre-Neolithic, and this comes from layer 14 consisting of brownish red murum. Palavoy II comprising layer 11 to 9 represents the Neolithic period and Palavoy III has been called post Neolithic, it represents layers 8 to 2 (Figure. 3.1.3).

The Neolithic culture designated here as Palavoy II and represented in layers 11 to 9, is separated from Palavoy I by a gap of two sterile layers. It is characterized by pecked and ground stone, and blade industries, bone tools, a copper objects, pottery, terracotta and clay objects, burials and human skeletal remains, animal remains and plant remains.

The physiographical and geological features have remarkably contributed to the establishment of Neolithic settlements at Palavoy. The Neolithic folk living in the open on the flat terraces made by

leveling the tops of the granite hills. The occupation was however not confined to the enclosed areas within hills only but also extended to the slopes and plains at the feet of the hills. There is no clear picture of the plans of the Neolithic houses in view of the limited nature of the excavations at the sites hitherto dug in the south. The only floor at Palavoy with many as 30 postholes is traced over layer 11, in trench 1, mound I. The postholes, roughly circular with a diameter of 8 to 20 cm. and depth of 8 to 48 cm., suggest a circular to rectangular plan of the house with mud walls and probably thatched roof. The postholes yielded considerable quantities disintegrated

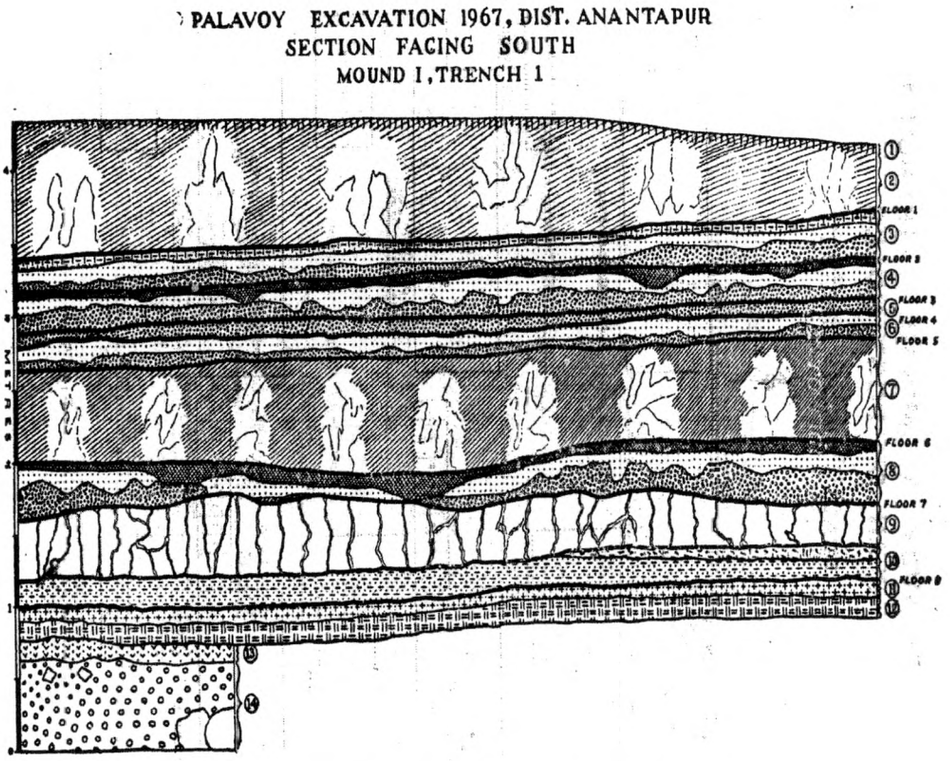


Figure. 3.1.3 Stratigraphic of Palavoy

wood of Acacia or Dalbergia species indicating their use as posts in house constructions. The floor is made of pale brown soil mixed with sand. Several circular to rectangular plans of various sizes of naturally placed or at times intentionally put huge granite boulders were noticed on the slope and top of the Palavoy hill. The roofs of these houses were probably conical.

The pecked and ground stone industry unlike the blade and microlithic industry is remarkably well represented at Palavoy. Eighty-four specimens were recovered from the excavations. Igneous rocks, both basic and acidic, comprising fine–grained basalts to medium to coarse – grained dolerites and epidiorites, granites, granodiorites, etc. were the most favored materials for the manufacture of artifacts of this industry at Palavoy. All these rocks are locally available in the vicinity of the site. The dolerite and epidiorites were must have been the chief source for making tools at this site and granites and granite gneisses were employed in making rubbing stones, hammer stones, querns, etc. The manufacturing techniques consisted of flaking pecking and grounding. These were employed either individually or in combination with each other in the preparation of a tool. Two broad categories of artifact types-the edge tools consisting of axes, adzes, chisels, wedges, chopper-chopping tools and scrapers, ring stones, anvils, etc.

The blade industry from the stratified deposits of Palavoy though poorly represented. The surface sites are however very rich in blade and blade tools. The artifacts, chiefly made of chert and less commonly of chalcedony, quartz, jasper etc., consist of blades, backed blades, obliquely blunted blades, truncated blades, lunates, trapezes, points, borers, and scrapers. The industry is based on the crested guiding ridge technique.

Besides the bone tools comprised scrapers, chisel, blades, punch and points are another significant feature of this period.

The ceramic industry consisting of blotchy grey, dull red, burnished and unburnished grey ware and painted red wares demonstrates a much-advanced skill. The blotchy grey and dull red wares are the most common and painted red ware which is most uncommon. The blotchy grey and dull red wares are mostly hand-made and painted red wares were manufactured with the help of some kind of mould. The fabric is very thin and fine. The most common types are globular pots, bowls and dishes.

The painted designs are confined to the surface of the pots usually on their neck and shoulder, sometimes on rim and occasionally on the interior of the neck. The designs consists of a simple bound, a band with vertical strokes above or below it, two parallel bands joined by vertical

strokes, a zig-zag, a lattice designs and sometime with chevrons and lattice design. Occasionally, a lopped with several vertical strokes.

The economic life of the people ranges from hunting activities to primitive agriculture. Several terrace-like flat spaces on hill slopes and top at Palavoy habitational places were apparently used for some kind patch agriculture. But no evidence of cultivated grains was obtained at Palavoy. However, the presence of querns and rubbers, indicate the practice of agriculture. Further, direct evidence for the practice of agriculture is provided by the discovery of charred grains of horsegram (Dolichos biflorus, Urali) from Tekkalakota (Sankalia 1964; Nagaraja Rao and Malhotra 1965) and finger millet (Eleusin Coracana, ragi) from Hallur (Nagaraja Rao 1966; Vishnu-Mittre 1971), and the proximity of these sites to Palavoy. The domestic species comprise cattle including larger bovines (Bos bubalis and Bos indicus), Sheep/Goat (Caprines), Canines and hogs. Majority of the bone belong to cattle. Most of the bones from the habitation deposits are charred, and show cutting or chopping marks on their surfaces. They must have domesticated cattle both for their milk and meat.

The evidence of the disposal of the dead at Palavoy came to light from trench 1, habitational area I in the form of four infant burials. All urns are of grey ware, urns consisting of a single pot covered with an

ordinary or lipped bowl, or two pots kept face to face. The urns were kept vertically as in Tekkalakota II and I. But unlike at these sites, the dead were buried outside the house but within the vicinity of the habitation areas and no burial goods were provided.

Radiocarbon dates for the southern Neolithic culture are available from sites of Utnur (2160 ±150 B.C), Tekkalakota (Between 1780 and 1540 B.C). Hallur (1710 ±105B.C and 1585 ±105 B.C), Sanganakallu (1590 ±110, 1550 ±100 and 1585 ±105 B.C), T. Narsipur (1805 ±100 B.C and 1495 ±100 B.C) and Bainapalli (1485 ±100 B.C).

It can be seen from the above dates that the southern Neolithic culture existed between 2000 and 1000 B.C. Majority of these sites evidences like painted pottery and copper occurred in the late levels. Similarly, at Palavoy, painted pottery, which figured in all levels, is more predominant in the upper from which copper was also known. In this site, the carbon date between 1800 and 1500 B.C. for the Palavoy Neolithic culture as well.

In short, the Palavoy Neolithic people were living quite a different way of life compared to their predecessors of late Stone Age. Many features such as round or rectangular houses, terrace agriculture, hunting activities, domestication of cattle, the use of saddle querns and rubbing stones as well as axes, ring stones, etc. are characteristic of this culture.

Palavoy ashmound

Four ashmounds (Figure. 3.1.4) are located along the western foot of a large conical peaked granite hill with deposits between the mounds and the hill identified as Neolithic habitation deposits (Rami Reddy 1978: 25-6, 30).

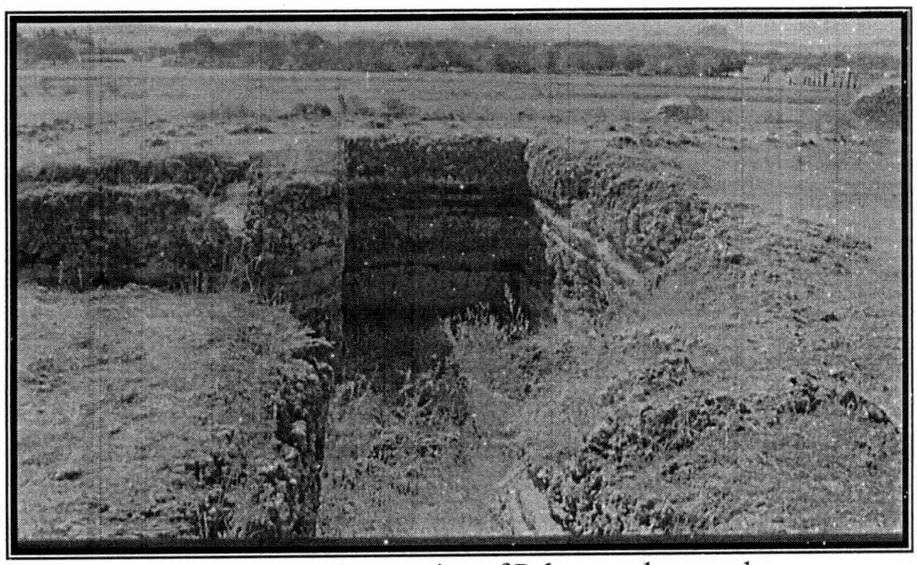


Figure. 3.1.4 Excavation of Palavoy ash mound.

Here as at several other ashmound sites Rami Reddy seems to have mistaken the highly vitrified dung lumps for iron slag. This site was explored during the survey work of Ramy Reddy (1978), who also undertook excavations with others from Deccan College of the northernmost ashmound (Rami Reddy 1976; 1977). The ashmounds are numbered from north to south. At ashmound two the lower northern edge of the ashmound was exposed down to the level artificial platform

which had been prepared before the dung accumulated. To the east of the main circular peak of ashmound II.

This site was also significant in the Iron Age, as there are several megalithic monuments here, including graves along the foot of the hill both north and south of the ashmound group (Rami Reddy 1978: 37). A large standing stone (menhir) is located to the south and west of ashmound II by about 210 meters.

Sanganakallu

The village is situated 5 km northeast of Bellary town, the district headquarters. Three hills namely Sannarachamma , Hiregudda, Chaudamma gudda constitute a chain of granite hills to the north of the village on top, which the archaeological sites are situated. Of these, Sannarachamma hill was excavated earlier (Subbarao 1947,1948; Ansari and Nagaraja Rao 1969) (Figure. 3.1.5). The excavations here have revealed evidence for Phases II and III of Allchin and Allchin (1982). The complex of hills is surrounded by a rolling plain characterized by a savanna environment with the *Acacia-Albizia amara* vegetational series, although most of the region is now under cultivation. The local soils on the plains range from reddish to light/medium black soils and are derived from the granite. Neolithic habitation deposits on the Sannarachamma hill is the largest and occupies a flat terrace on top of

the hill encircled by granitic torso. Towards the west of the cluster of ashmounds there is evidence for less intense occupation, which includes a number of stone built structures with ground stone tools and occasional pottery, the habitational soil being very thin.

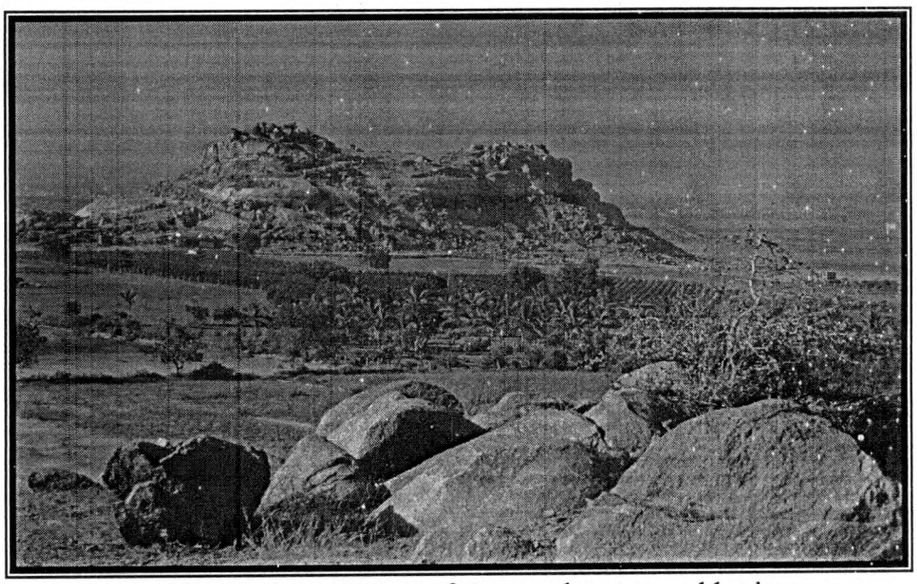


Figure. 3.1.5 General view of Sanarachamma gudda site.

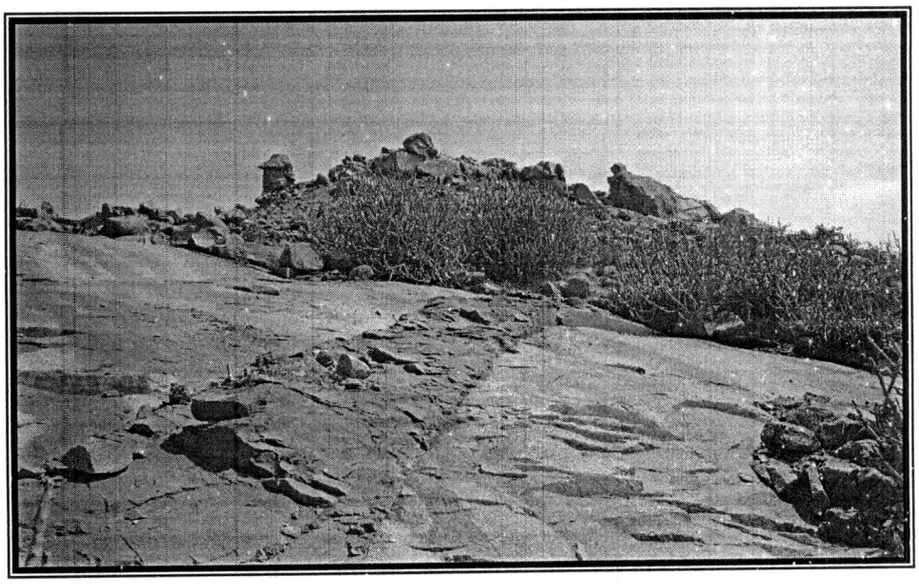


Figure. 3.1.6 View of dolerite dyke.

There is an extensive dyke running through Hiregudda and there is evidence for the manufacture of flaked and ground stone tools from this dolerite rock (Figure 3.1.6). In addition there are numerous rock bruisings on the dyke. The depictions include cattle and human figures (see Gordon 1951; Allchin and Allchin 1995). There is a group of three ashmounds at the eastern foot of Hiregudda, known as Kupgal ashmounds (Mujumdar and Rajaguru 1966).

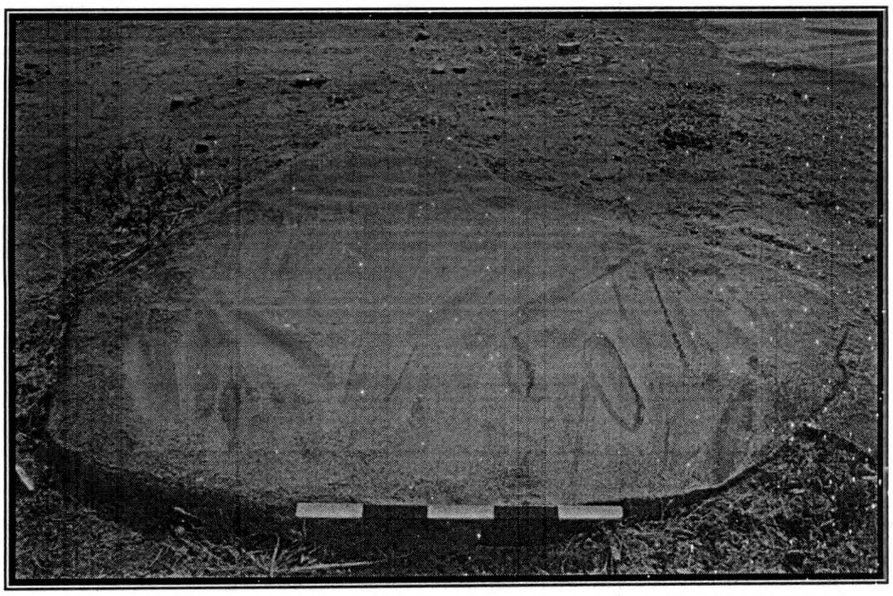
The other hilltops also have Neolithic sites. On the Choudammagudda hilltop there is a large scatter of Neolithic surface finds on the artificial terrace surfaces. There is also a small denuded ashmound situated at the shoulder of the hill overlooking the village of Sanganakallu. This appears to have been sporadically occupied, probably a seasonal occupation. On Hiregudda hill there is an area of deeply stratified cultural deposit (Fig. 1), west of this area were light scatters of lithics and pottery.

Sanganakallu was a 'factory' site located near the source of basalt or trap rock, from which the axes and other tools were made, it was possible to collect a large number of axes in all stages of manufacture. The main types of tools are axes, chisels, picks, fabricators, pounders, discs, hoes and mace heads made of dolerite dyke.

Neoltihic pottery is represented by Phase II with two subperiods. Subperiod 1 is 'True Neolithic' characterised by coarse brown and black pottery with a dominance of pale grey ware. Subperiod 2 pottery is represented by pale gery ware along with the dominant borwn and black wares. A few sherds with violet and purple paintings on a dull background were also found. In general the Neolithic pottery is crude and coarse in fabric all of which is handmade, some show burnished surfaces (Subbarao 1948; Ansari and Nagaraja Rao 1969).

Grinding Grooves

The evidence to show how the axes were ground, particularly their edges, was first noticed by Foote (1887; 1914: 92, 1916: 87 and 117) in the form of rock grooves on the 'North hill' of Bellary town, east of Helalagundi (Halalagondi) in Alur taluk of Kurnool district and at Pullayyagudda in the former Hyderabad state. Similar grooves were found by De Terra (1942) on a quartzite boulder at Burzahom in Kashmir, and later by Subbarao (1949: 144) at the southern foot of Sanarachamma hill on an exposed boulder in the open fields (Fugure 3.1.6.).



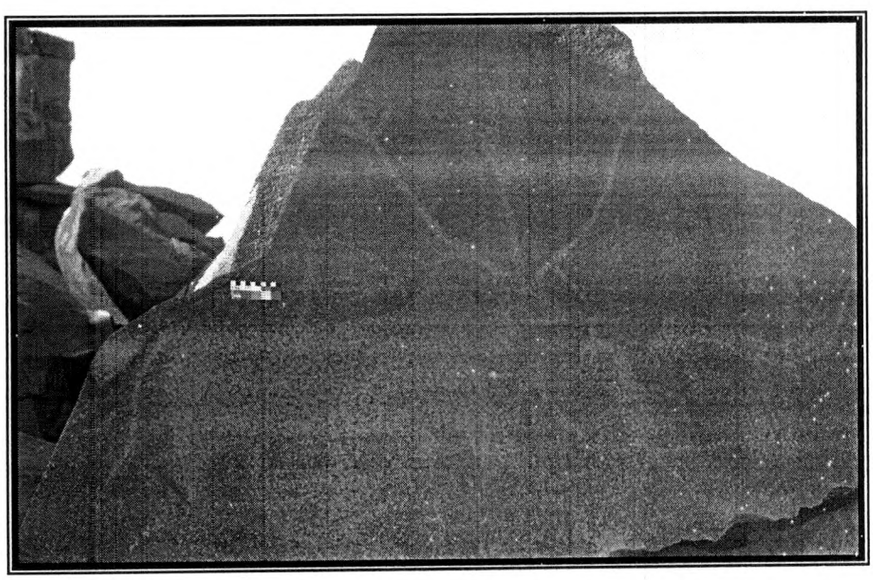
Fugure 3.1.6. Grinding grooves from the base of the hill of Sanganakallu.

The grinding groove was found on the northern slope of the Uravakonda pointed hill on the surface of a big granite boulder around which more than half a dozen saddle querns were laying. Four more such grooves were found on the eastern slope of the Havaligi hill and a few on the western slope of the Lattuvaram hill, both, in the administrative jurisdiction of Uravakonda independent sub-taluk of Anantapur district. Three similar grooves, measuring 25 to 40 cm. long and 2 to 4 cm. deep, were noted at the western foot of the Palavoy hill close to the north of ashmound 1 on the top and western slope of a big granite boulder.

At all these localities, a number of water ponds and springs around, in the vicinity of grinding grooves, were also observed. This indicates that the Neolithic man had made use of this pond water and some sand-like abrasive while rubbing the axes.

Rock Bruishings

In 1891 Fred Fawcet, Hubert T. Knox and Robert Sewel, in one of their "excursions" to the 'Kupgal' hill stumbled on a rock picture on the perpendicular face of the eastern end of the trap dyke. They examined the whole hill and discovered very interesting rock bruishings all along the trap dyke (Fugure 3.1.7). These bruisings are lightly bruised on black diorite. They selected the black diorite boulders of the trap dyke to show their drawings in good relief. Today these (including old and new) are to be found all along the length of the dyke across the hill for nearly 200 meters.



Fugure 3.1.7. Brusings from Sanganakallu site.

The trap dyke at Kupgal runs in a N.W. by W. directing across the northern end of 'Kupgal hill' locally called Vittalappagutta. Foote located them on the north side of the hill on the trap dyke "which has

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weathered much more slowly than the surrounding granite and stands in a conspicuous low cliff." Probably Fawcet when he refers to the "east end of the trap dyke" refers to the same low cliff, where some graffiti can still be found. On the other hand Francis has located them "high up among the dark rocks which form the crest of the trap dyke on the northern end of the hill". Thus it can be seen that the graffiti are located all along the length of the dyke, at varying heights.

The best representative and well-preserved group is to be found right on the crest of the hill on the steep face of the dyke, which is nearly 500 feet above the surrounding plain. This group is located just north of the reverted terraces and other traces of old habitation referred to by Foote. Here all the earth has been washed away and now they find them on confused piles of perfectly bare boulders.

Another good group is to be found just away from this at the foot of the hill, where the dyke comes down.

The technique consists of striking or bruising or etching lines with a sharp pointed stone. Hence they are not deep but only look white on account of the black colour of the face of the rock on which they are bruised. There is no evidence of any iron tool being used, as it would have left deeper impressions. This also accounts for the fact that many

of them have faded away. Only those which are not directly exposed to the forces of Nature have survived.

The figures are made in two forms: (1) The drawing in outline, and (2) Drawings in full, where the whole space is also made white. But most of them are in outlines. The human figures appear either in stick-like convention or in outline. Most of the figures belong to the former category. The important animals depicted are oxen with prominent humps and very long horns (different from the existing breeds), buffaloes, dogs, antelopes, deer, leopard, elephants and peacocks. Besides there are many composite scenes which may be mostly hunting scenes.

Ashmound

The Sanganakallu area includes a range of Neolithic site types, which provide a perspective on the diversity within a local settlement pattern. The three hilltop sites, Sannarasama hill, Chaudammagudda and Hiregudda (Kupgal hill, or the 'Peacock Hill' of Foote 1916) are all inter-visible, and contemporary occupants would certainly have been aware of each other and able to communicate through displays or signals. This intervisibility seems to imply that these different categories of sites in close proximity should be seen as part of a local settlement system, perhaps of a socially integrated group. The Kupgal ashmounds

are not visible from any of the hilltop sites, but must have been known, and perhaps served as important gathering places on ceremonial occasions when the dung accumulation was burnt. Both Hiregudda and Sannarasama hill represent permanent communities, with deeply stratified habitational sequences that yielded plant remains. Choudammagudda (CDM; Subbarao's [1947] "Saudamma Hill"). There is a large quantity of

Kupgal Ashmound.

Located northeast of Sangankalu village and directly south of Srivaram village (a Boya community) these ashmounds are named in consistency with earlier workers. Two of these ashmounds are extant while a third has apparently been destroyed by the development of a small road, quarrying and plowing. There appears to be some habitation perhaps between 50 and 100 cm thick originally located west of Ashmound (Fugure 3.1.8) designated 1 and excavated by Majumdar and Rajaguru (1966), third one is now extinct ashmound. This area now a ploughed field and it is unlikely that intact contexts could be found here. A small remnant of other ashmound was located on the north-east facing slope of the Kupgal hill (Hire-gudda) west of these ashmounds, as were three or four small habitation terraces with thin artifactual catter and quern stones.

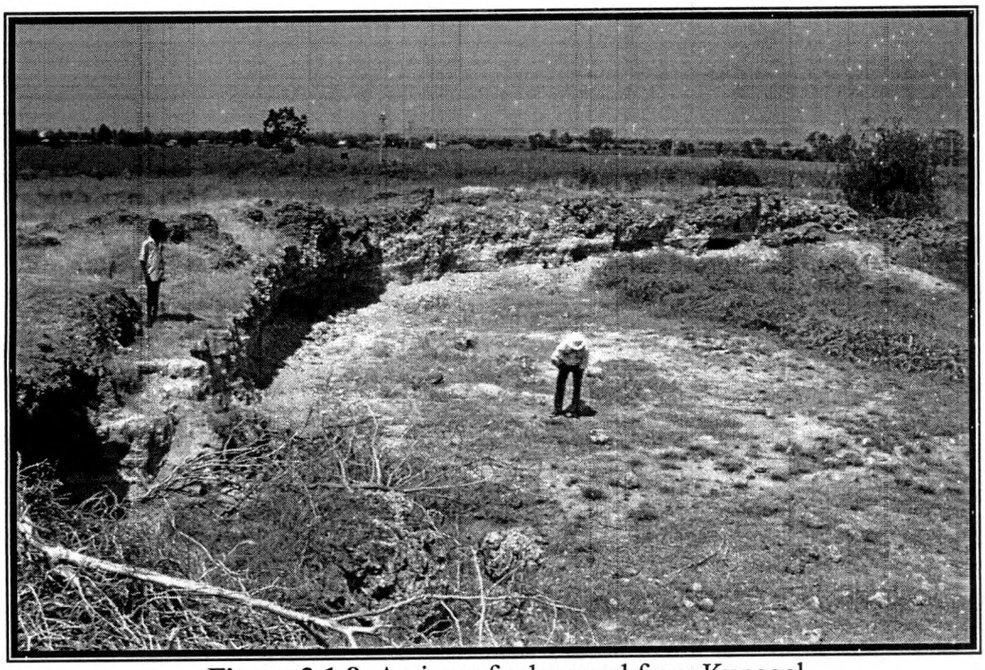

Figure 3.1.8. A view of ashmound from Kupagal.

An erosional run-off gulley west of ashmound, due to quarrying activities, a section was exposed which exhibited the habitation deposits. These deposits visible as a gray layer in the gully section directly overaly the red, sandy, granite-derived sterile soil. There was no evidence in this exposure for the dark 'palaeosol' horizon nor did the pebble layer report by Majumdar and Rajaguru (1966) as underlying Ashmound I. This calls into to question whether the layer they found was in fact natural; alternatively it might be seen as an artificially silt.clay layer built up to level the site before camping and penning was carried as it known at Kudatini and Utnur (Korisettar et al 1999). This has important implications for interpreting these deposits in terms of environmental conditions, as Mujumdar and Rajaguru have done. The "gravelly detritus as parent material" recorded beneath this "dark brown

soil" is mysterious as it overlies a layer that is probably granite-derived sandy soil (that is probably equivalent to the sterile layer in the gully exposure) and includes dolerite flakes. It is not clear how a layer of coarse pebbles could have accumulated atop a natural, sandy granite derived soil by natural processes. This takes on importance in the interpretation of the date of the dolerite/greenstone flakes as they simply predate the platform at this particular ashmound and could therefore be early Neolithic in date. Indeed, these flakes resemble debitage from Neolithic Celt manufacture. Medium black soils now under cultivation surround these ashmounds. Kupgal hill (Hire-gudda), with a large dolerite dyke raises directly to the west of this site. This dyke turns southward and extends into the plain south of the ashmounds.

3.2. Features of Southern Neolithic

The study of South India Neolithic as did by Allchin, shows that the Neolithic of South India underwent a long evolutionary process culminating in the beginning of the urban centers in the first millennium B.C. This long process of evolution which covered a time span of over 1500 years was divided by him into three phases, the early Neolithic, the mature Neolithic and late Neolithic (Allchin, F.R.B. 1968: 161-170). Each of these temporal divisions is characterized by certain distinctive features of its own. The present writer while appreciating the three-fold

division proposed by Allchins, tried to project the cultural attributes of Neolithic in south India more comprehensively to suit all the available excavated data.

Early Phase

The early Neolithic phase of south India is represented by utnur, Kedekal, Brahmagitri is and early phase of piklihal. At Brahmagiri a stratigraphic gap separates the early and late phases of the Neolithic. The settlements are confined to tops of lowlying granetoid and schistose hills surrounded by vast stretches of fertile black cotton soils. The sites selections seem to have been prompted by availability or raw material, cultivable plots and fodder for domestic animals. The settlements were very small in extent and one such at Utnur measured 180' x 180' m. The information about the structural activity is scanty and basing on a group of postholes at Utnur, it is inferred that light super structures were raised on wooden posts.

The pottery is handmade and consists of both coarse and fine fabrics. There was a liberal admixture of mica and clay used for pottery manufacture. There was a wide range of surface colors – red grey, pale grey, buff, brown and black. Sherds of the finer fabric were generally slipped and furnished and sometimes even painted in red ochre and black. The pre-fired black-on-red ware is very limited and the painted

motives include horizontal or vertical bands, criss-crosses and wavy lines. A solitary example from Brahmagiri contains 'Highly conventionalized plant design (Wheeler, R.E.M.1948).

The red ochre paintings were usually post fired in nature, recovered in large numbers. At Utnur it occupied 40% of the total grey ware. The painted motifs constitute horizontal or vertical strokes, mostly executed on the top or the edge of the rim. There was only a limited number of post-forms-wide mouthed globular vessels with out-turned or flared rims, bowls with convex and straight profiles and dishes of various dimensions. Piklihal and Utnur provide yet another rare example of bowl/dish with multiple legged stand. The lugs and handles occur in a limited quantity. Ground stone implements and stone blades form the stone tool assemblage. These are crude and unsophisticated and seem to have been made on a locally available raw material. Brahmagiri has yielded. Kodekal has one edge ground are where us Utnur is devoid of any few specimens from the surface. Piklihal has 9 edge tools from this phase. The edge tools of the early tradition fall in axe group and the absence of special tools like adzes, chisels and picks is noteworthy.

The chipped industry of this period was limited and comprise of 'rudimentary flake or blade tradition'. At Brahmagiri 9 out of 89 specimens recovered belong to this phase. The crytpo-crystalline silica

material was the chief raw material here. Utnur has 34 specimens made on quartz or other similar materials. Kodekal produced as many as 202 specimens number of tools from Piklihal is not known. The finished tools include blade backed blades scrapers and points which were crudely fabricated. The absence of retouch was an important feature of the industry.

Information about the disposal of the dead is scanty though there is every reason to expect systematic buries practices in this period. Of all the sites, only one instance was recorded at Utnur wherein an infant was buried in a pit in fontal position.

The economy of the period was a mixed one and included both food collection and food production. Hunting and fishing played an important role. Though there is no direct evidence of plant cultivation, the presence of querns, mullers suggests some sort of cereal and grain processing activity. Utnur abounds in cattle bones. However, the remains of deer and goat were also obtained at Utnur. More and above Utnur, Kodekal, has produced unmistakable evidence of the dog, owl, fish fowl and wild animals like gazelle, spotted dear, baraisngh, monitor lizard. Bhahmgiri and pikkihal have produced similar evidences. The domestication of cattle and other animals was once again confirmed in

the terracotta figurines found at piklihal and Utnut. Some rock bruisings at piklihal give the evidence of cattle.

Mature Phase

Around 1800 B.C. there appeared a sudden change in the Neolithic culture of South India, which resulted in the dispersal, and diversification of the culture emanating from Raichur and Bellary doab. This change might be due to the movement of the goods if not people might be due to the movement of the goods if not people, possibly from Western Deccan. Though the impact of the movement and consequent introduction of metal and other techniques is considerable. It could not mould the basic economic structure of the movement and movement is consequent introduction of metal and other technique is considerable, it could not mould the basic economic structure of the Neolithic society. The regions to which the culture spread include the upper Krishna basin in the north, Tungabhadra basin in the west, Kaveri and Kapila rivers in the south and lower Krishna basin in the east (Paddayya, K. 1973). The carbon dates also give testimony of the later settlements in the 4 regions mentioned. The fundamental features of the phase are revealed in Brahmagiri Ib, Maski Ia, Piklihal upper Neolithic, Sanganakallu IIa, palavoy IIa, Hallur Ia, T. Narsipur Ia, Tekkelakota Ia, Hemmige Ia and Paiyampalls early phase.

A change in the settlement pattern is evidenced in this period. The tops and the slopes of lying garneted and Schistose Mountains those were hitherto habitudinal grounds for the early Neolithic settlements preferably by the side of a perennial rivers. Hallur, T, Narsipur and Hammige may be cited as examples of this kind.

The information about structural activity is clearer in this phase. The structures were raised on wooden posts supported possibly by conical thatched roof. The uneven ground was leveled and rammed either by red morum pebble chips or by both. The leveling process at times continued for two or three times at Sanganakallu. At Tekkelakota, lime plastered floors exist. The walls were raied by mud and supported by wood or bamboo screen. The stone wall for certain height and later followed by mud well was also noticed at Tekkelakota. The houses were circular in shape and the large post and smallest houses measure 5.5 m x 5 m 3.3 m x 3m respectively. Hearth formed a common feature inside the structure and at Tekkelakota and Sangankallu, 'bin rests' were also recorded. The cultural materials recovered from the structures include pottery; ground stone celts, chipped, querns, mullers, pounders etc.

The ceramic products changed considerably in this period. The pottery was predominantly handmade at least in the early centuries of the phase, but however, in the closing centuries, there occur specific

evidences for the introduction of turntable. The red, black and chocolate whereas decrease gradually and finally disappear. The brown ware occurs abundantly along with grey were. Buff ware, however, persisted. In the surface treatment, there appears degeneration as unslipped and unfurnished shreds begin to occur in large numbers. Most of the shreds were made on gritty core and finished by uneven firing. This has resulted in steep rise in blotchy shreds. The other feature was the prolific use of anvil and dabber in the preparation of the pots. Looting the rim portions to body of the pot after they were made separately was another feature. The pot forms of early tradition continued with an exception to legged vessels bowls with exerted or out-turned rims, dished basins and lids. The handles and lugs occurred in large numbers. Tabular spouts, channel spouts and lipped bowls occurred for the first time. Hallur, T.Narasipur and Hemmige provide terracotta 'head rests', yet another new features of the period, for which there are no parallels in India (Nagaraja Rao, N.S.1970: 141-48).

Regarding the painted were, black painted red ware of earlier tradition discontinued from all the sites expects Palavoy where the same continued till the end of Neolithic age. The red ochre painted ware however continued without a by change either in decorative motifs or in

painted designs. Incised, finger tipped and appliqué proliferate. By the end of the period there occur brown-and-black wares.

The ground stone tools are extensively prepared and this was stratigraphicaly documented at Brahmagiri where out of 15 complete and 29 broken edge tools, 14 complete and 25 edge tools were from this phase. Palavoy, Sanganakallu and Pikiihal were the other sites where prolific occurrences of edge tools were recorded. The sites like Hallur, T.Narasipur, paiyampalle and Hemmige though rich in ground stone tools, were devoid of raw material and unfinished tools in the strata. This led the excavators to think in terms of trade contact with the tool breeding centers. Adze and chisel, which generally considered as carpenter's tools are fund for the first time in the stone assemblage.

The differential distribution pattern as evidenced in the ground stone tools in the early phase and the succeeding phases is also apparent in a s6tone blade assemblage also. Here also Brahmgiri provides an important piece of evidence and 80 out of 89 microfiches recovered are from this phase only. Not only at Brahmigiri, at several other sites like Piklihal, Tekkelakota, Hallur, Sangankallu, Hemmige this is represented by large number of microliths. T.Narsipur, Palavoy and Paiyamapple, the chipped stone industry was very limited and it might be due to the paucity of suitable raw material. Maski produced long blades measuring

to 5.5 cms. Blades were the dominant feature of the industry. Other tool types include scrapers, points, lunates and trepazes. The created guiding ridge technique was known.

The information about the disposal of the dead is prolific in this phase. The dead buried either in urns or in pits. The infants were buried in urns preferably under the house floors. The urns meant for this purpose were free from decorations. The skeletons of the infants were tightly folded in an embryonic posture to fit the restricted space inside the pots. The funerary offerings were very rare and only at Brahmgiri a bronze rod and a ground stone tool were recorded.

The adults were buried in oblong pits usually outside the house. At Tekkelakota these pits were roughly measured 1.60 m long, 0.45 cms broad and 20-40 cms deep. In the pit burials two kinds of burials, two kinds of burials were prevalent viz., complete inhumation and fractional burial. In the former the dead were buried in extended position whereas in the latter the bones were collected and arranged in anatomical position. The skeletons lay to their back with a tilt of the head either to right or left. The orientation was South North but not in all cases. At Tekkelakota adults were buried in a single pit, and this event is attributed by the excavator to communal burial. Some of the burials at Tekkelakota were covered from head to the extremities by flat granite

boulders. The funerary offerings varied. These include globular vessels, lipped bowls, spouted bowls, metal implements, ground stone tools and microliths.

Copper was introduced in this period and reached all the sites. However, its impact on the Neolithic economy and culture was very little and hence Neolithic folk of this period mainly persisted on stone and bone implements. The smelting of metal appears to be unknown as none of excavated sites gave any evidence about it. The finished state of the implements might suggest that the tools reached south India either by trade or cultural exchange. Palavoy provides the earliest evidence of copper in South India and the 14 carbon date obtained here is 1965 ± 105 B.C. (Reddy, V.R. 1976: 119).

The other sites of the same region give younger dates for this event at least by 150 years. At Hallur, earliest date is 1710±105 B.C. T.Narsipur 1805±105 B.C. If an average date is taken into consideration, 1800 B.C. would suit the occasion. The copper tool types of this phase were very limited and include chisels, Celts, rods etc. Added to copper, there were evidences for gold ornaments from T.Narsipur and Hallur.

The economy of the people was mainly based on food gathering and food production. Hunting and fishing still played an important role. The wild animals that were hunted include spotted deer, rat, antelope,

hog and gazelle. Shell fish was another dietary feature of the people. Added to these, the remains of domestic animals like ox, bufalow, sheep, goat, were also recorded in this period. Hallur provides the earliest evidences for cultivation of Ragi (Eleurine coracans) while Takkalakota provides the evidence for horse gram (doliobs biglorus). Evidence of both these specie besides that of green gram (Phaseolus rediatus) was also found at Paiyampalli in Tamilnadu (Rao, S.R. 1967-68:26-30).

Late phase.

Around 1400 B.C. or so, there appeared yet another cultural movement possibly from northwest. This is represented by Jorwe culture, which along with its wheel thrown black painted red sherds and other cultural traits intruded into South Indian Neolithic culture. The main features of the movement are recorded in Tekkalakota Ib, Piklihal late levels of upper Neolithic, Brahmgiri late levels. Sanganakallu II, T.Narsipur Ib, Hemmige Ib, Paiyampalle Ib, and IIb of Palavoy.

This period had witnessed drastic changes in the ceramic industry. The grey and pale grew wares decreased considerably and way to brown, dull red and brown and black wares. The coarse gritty fabric was more prolific. The red ochre painted wares of earlier tradition either diminished or completely vanished from the ceramic products. Wheel

made sherds, found prolific though there occur handmade sherds along with the wheel made black painted red ware of Jorwe fabric occurred from all the sites in a limited quantity. The painted designs include horizontals or vertical bands, crises-crosses, etc. The pot forms of the previous phase continued besides new introductions like globular vassals with out-cut rims, tabular long spouts etc. The ground stone tools and microliths exist as in the previous phase. Beads also occur without much variation either in the raw material or in shapes. However, the new introduction was terracotta heads at Brahmgiri and Tekkelakota with 2 and 5 respectively.

The copper objects were prolific when compared to the preceding phase. These were small in size and comprise both rods and pins. At Piklihal a broken miniature copper bowl occurred whereas Tekkelakota there were four objects viz., a spiral, a wire, a rind and a nail head. Hallur has produced three objects of which one was a fish hook, while remaining two were miniature axes. At Brahmgiri a bronze ring was recorded. Paiyampalle is the only site where not even a single copper bit was recovered. The significant feature of the phase is the absence of evidences for smelting of metal.

As for the disposal of the dead, the traditional method of previous phase continued. The new evidences were double and multiple pot

burials. In the double pot burial, the pots were kept mouth to mouth and generally infants were buried in extended posture. The funerary offerings were very rare. Hallur, Tekkelakota, Palavoy, T.Narsipur and Brahmigiri have preserved very good examples of this kind. In a multiple pot burials at Tekkelakota, four urns were used. The Skelton that was buried in this burial was kept in North South orientation. Rich funerary offerings were recovered from this burial which includes nine pots of various dimention. At T.Narsipur a skeleton is found in a cradle shaped pit covered either side by two post holes. These post holes must have belonged to a roof over the burial. At another instance at T.Narsipur, the skeleton is found without ankles, which was interpreted by the excavator as a deliberate act upon the people to keep the spirit within the grave.

The economy of the period mostly depended upon the production of food grains and domestication of animal. However, there are evidences of hunting and fishing. The faunal remains of ox, sheep, goat, buffalo, dog or ragi and horse gram as evidenced in the previous phase seems to have continued in this phase also. Besides these, Paiyampalle provided yet another evidence of the cultivation of green gram (Phaselus radiatus)

Ashmound Tradition

Ashmound are unique to the Southern Neolithic and have been the subject of much debate for over 150 years when they were first noticed. It was Col. Colin Mackenzie, the first Surveyor General of India who discovered few of these features including the Kudatini ashmound during the preparation of topographical maps of parts of Karnataka and Andhra Pradesh in the early 19th century which was followed by a few more in the Shorapur Doab by Col. Meadows Taylor in the 1850s. But it was Robert Bruce Foote who not only discovered a number of ashmounds and Neolithic habitation sites in the Bellary–Anantapur region but was also the first among those who have strived to find out the age and origin of these features. Many views are propounded about the origin and age of these ashmounds. Their association has been drawn from Neolithic cattle dung heaps by scholars to cremation grounds of rakshasas or demons of Hindu epics like Mahabharata in the local legends and myths. They have been thought to result from industrial activities like iron-smelting, gold smelting, brick making and pottery making activities. Cole has argued that the ashmounds are in fact geological deposits like kankar formations, limestone slag and volcanic ash. They have also been linked to the mass satis committed by women during the Vijayanagar period. But all these

theories have now been put to rest by many-repeated analysis, which have proved beyond doubt that these ashmounds are results of repeated or periodic burning of large quantities of cow-dung during the Neolithic period.

The Ashmound Tradition was a distinctive archaeological culture of northern and eastern Karnataka, and parts of southwestern Andhra Pradesh, dated broadly between 2800 cal. BC and 1200 cal. BC (Allchin and Allchin 1982; 1997; Devaraj et al. 1995; Korisettar et al. 2000). Drawing on recent fieldwork by Dorian gave recent archaeobotanical analyses (Fuller 1999; 2001a; 2001b; Fuller et al. n.d.), in this study several issues regarding the contributions of pastoralism and cultivation to the subsistence economy and the permanence and seasonality of different categories of South Indian Neolithic sites.

The Ashmound Tradition can be distinguished from other regional varieties of India's Southern Neolithic by the presence of the distinctive ashmound sites (Allchin 1963; Paddayya 1973; 1992; Korisettar et al. 2000). These sites are mounds of dung ash up to 8 meters in height, which were formed through the episodic burning of large quantities of accumulated dung (Fugure 3.2.1). That these mounds resulted from the accumulation of cattle dung was proposed by Foote (1887a; 1916), and subsequently supported by the studies of Zeuner

(1959), Allchin (1954; 1960; 1961; 1963a), and Mujumdar and Rajaguru (1966). The presence of Neolithic material in and around the mounds established their general period, and a few mounds have since provided congruent radiocarbon dates (Paddayya 1971; 1992; 1993b). The chemical make-up of the mounds is similar to that of modern cattle dung ash (Zeuner 1959; Allchin 1963), and they were shown to contain grass phytoliths, as would be expected in the dung of grazing animals (Zeuner 1959; Mujumdar and Rajaguru 1966; also Kajale and Eksambekar 1997). These animals must have been primarily cattle, as cattle dominate all Southern Neolithic bone assemblages, with only trace presence of caprines and wild fauna (Alur 1969; 1971; 1990; Paddayya 1975; Badam 1984; Thomas and Joglekar 1994; Paddayya et al. 1995; Joglekar in press;). In addition, at the site of Utnur actual cattle hoof-prints were preserved in a pen-like enclosure sealed by the ashmound layers (Allchin 1963). A similar pen enclosure has been revealed at Budihal (Paddayya 1998). The suggestion that the ashmounds were slag or other materials from metal working and of Iron Age date, a hypothesis which was popular in the early part of this century (see Allchin 1963a), has been promoted recently by two authors (Rami Reddy 1976; 1977; 1978; 1990; Sundara 1971c; 1975: 178; 1987); however, these arguments are completely unconvincing and have been adequately laid to rest elsewhere (Allchin 1963a; Paddayya 1992;

Korisettar et al. 2000). Thus we can take as given that cattle were penned at ashmound sites during some portion of the Neolithic period. These sites are associated with varying amounts of archaeological material adjacent to the ashmound.

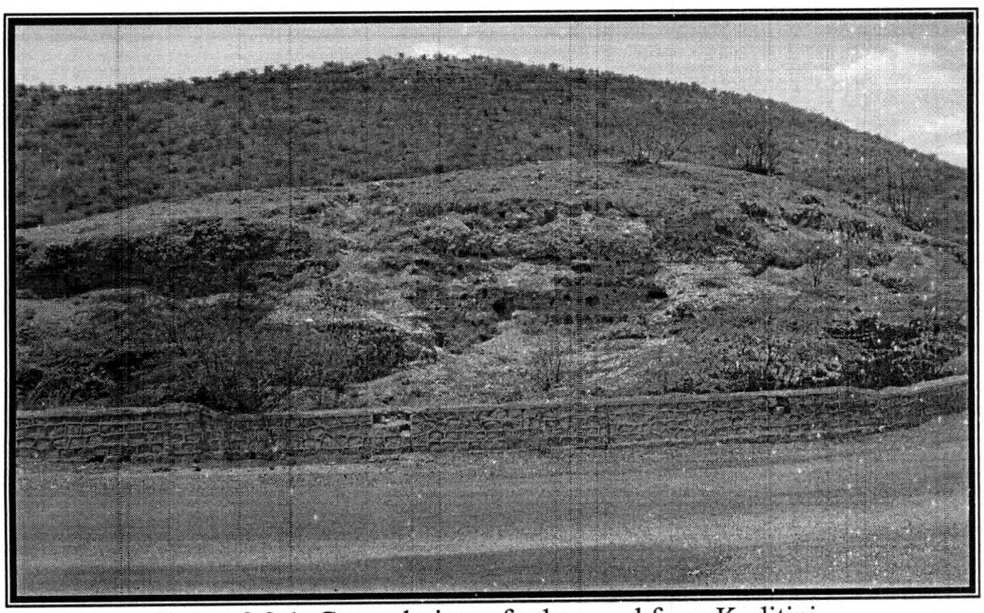

Figure 3.2.1. General view of ashmound from Kuditini.

In addition to the ashmounds, there are additional habitational sites. These sites are characterized by archaeological strata containing pottery, lithics, animals bones, and other finds, as well as structural features, including post-hole defined dwellings and pits (e.g. Wheeler 1948; Subbarao 1948; Allchin 1960; Nagaraja Rao and Malhotra 1965; Ansari and Nagaraja Rao 1969; Deveraj et al. 1995). Flotation carried out at these habitation sites has provided evidence for the reliance of cereals and pulses, including predominantly two pulses and two millet-grasses that were native to the Indian peninsula (Fuller 1999; Fuller

2000b; Fuller et al. n.d.). The vast majority of these habitation sites are located on the tops of castellated granite hills (tors) that rise in clusters above the flat plains of the south-central Deccan. By contrast many ashmounds are located on the plains, and in many cases near the bases of hills. A few non-ashmound habitation sites are known that do not occur on hills, such as Watgal (Deveraj et al. 1995).

Although not all ashmounds and hilltop sites can be assumed to have been contemporaneous, it is clear that they overlapped. The Ashmound Tradition can be divided into three main phases (Allchin and Allchin 1982; Possehl and Rissman 1992; Devaraj et al. 1995). The first phase can be placed between 2800 and 2300 cal.BC on the basis of a number of radiocarbon dates from different sites. Several ashmounds date to the first phase, or began to accumulate during this period, whereas there is relatively little hilltop settlement debris yet dated to this period. Non-ashmound habitation sites that have been shown to have levels dating to this period include Watgal (Deveraj et al. 1995), Brahmagiri (Wheeler 1948), and Piklihal (Allchin 1960). Other major habitation sites, including the hilltop sites at Sanganakallu and Tekkalakota begin in phase II, dated from 2300-1800 cal.BC. In many cases there is evidence for some inclusion of ashmound-like deposits (i.e. burnt dung, sometimes scoriaceous) at the non-ashmound sites,

including Brahmagiri, Sanganakallu and Hattibelagalu, but these burnt dung deposits represent inclusions in site stratigraphy of relatively small proportion. These habitation sites continue into phase III (after 1800 cal.BC) and a subsequent transitional phase to the Megalithic/ Iron Age period (from 1200 cal.BC). During phase II, ashmound sites declined. Some are abandoned, such as Utnur (Allchin 1963) while others continued, including Kupgal (Allchin 1963; Allchin and Allchin 1968) and Budihal (Paddayya 1993a; 1993b). Thus while there may have been a general trend towards the proliferation of hilltop settlements and the disappearance of ashmounds in the late third millennium BC, it is clear that these categories of sites did co-occur in some regions for sometime at least.

The ashmounds were divide as the Ashmound Tradition sites into three main categories, including the non-ashmound, usually hilltop, settlement sites, and two categories of ashmounds representing long-stay and short-stay encampments. These two categories of ashmound represent different aspects of the seasonal rhythms of transhumant pastoralists. Although there is no direct evidence for the seasonality of ashmound sites, a highly plausible seasonal cycle will be developed on the basis of the evidence for cultivars from hilltop sites. In order to relate the ashmounds and hilltop sites we must have an understanding of

the nature of pastoralism and its relationship to the plant-based facets of the economy.

Problem of Ashmound

Ashmound are huge mounds of burnt and vitrified ash made up of heaped of cow dung, usually located within or in the vicinity of a settlement and within the settlement itself. They have been noticed in the region of the Krishna Tungabhadra valleys comprising parts of District Belgaum, Bijapur, Gulbarga, Raichur, Bellary, Mahbubnagar, and Ananthpur. Some of the Ashmound sites are Kupgal, Sanganakallu, Halakundi, Lingadahalli, Kanchagara, Bellagallu, Nimbapuram, Kudatini, Kudachi, Budihal, Gaudur, Wandalli, Kakkera, Piklihal, Manvi, Sirwar, Budinni, Benkanalli, Kallur (all in Karnataka) and Utnur, Palavoy and Kodekal (all in Andra Pradesh)

By the early 1800s, these Deccan mounds had began to attract the attention of colonial administrators and explores in south India. Newbold (1842) recorded that locals believed the mounds to be the burnt bones of the enormous giants or 'Rakhasasa' who once inhabited the earth. Early reports on mounds by Mackernzie (Discussed in Talors 1838), Taylor (1838) and Newbold (1836,1842) set in motion a century-long attempt by various investigators, both Indian and British, to explain the origins of the enigmatic 'ash mounds' as they eventually came to be

known. Interpretations included suggestions that the mounds were natural limestone or volcanic formations, by-products of stone sort of industrial activity (glass-making, iron-or gold-smelting, brick-making, etc.) or mass funeral pyres where communal sati had been performed or bodies had been burnt after some great battle or massacre.

Later in the last quarter of the last century a professional geologist, Robert Bruce Foote (1887:259-82), who in his intensive quest for archaeological remains found ash mounds at a few places and thought that these were the result of accidental burning of cow dung by the Neolithic fold with whose remains they are sometimes associated. Foote describes some of these as CINDER CAMPS whose information in the Indian Peninsula he equates with the ZERIBA PROCESS practiced in the east Africa villages. Following Foote's work Messrs Hubert Knox, and Fred Fowcett excavated in one of the Kupgal mounds and agreed with Foot's observations.

After a few years Robert Sewell (1899:1-16) visited some ash mounds in Bellary district and accepted the so-called ZERIBA PROCESS, but stressed that the ash mounds were the outcome of vast funerary sacrifice of the medieval times and this was disproved by A.H.Longhurst (1912-13:145-7). Captain Leonard Munn (1927-28: 27) discovered many stone circles covered all round by identical ash at a

number of places. He also noticed at one place a circle of huge stones on the top of an ashmound. Gulam Yazdani (1935-36:20) of the former Hydrabad Archaeology Department opined that the ash mounds were the ancient gold-and iron-smelting places. This theory gained popularity hen later workers such as Sir Leonard Woolley (1940:191) and K.N. Dixit supported it. In 1949 Subbarao Attributed ash mounds to some industrial activity. Zeuner (1959:37-44) on the basis of his analyses of ash samples collected from a number of mounds concluded that they are of burn cow dung. From the exaction at Utnur Allchin inferred that the ash mounds were the result of ritual burning of cow dung accumulations in Cowpens by the Neolithic pastoral communities. Rami Reddy exactions at the ash mounds site of Palavoy unveiled interesting evidences comprising megalithic pottery, iron ore and slag pieces apart from two iron implements, his observations concluded that the ash mounds were probably the result of primitive iron smelting by post-Neolithic communities. Majumdar and Rajguru (1966:47-9) excavated in the Kupgal ash mounds I. Their interesting laboratory analysis of the ashes and slags indicated that cow dung was used in the burning and a temprature of 1250oc was required to change the soft cow dung ash to a vitrified type. Paddayya's (1973) stratigraphical scraping of the ash mounds at Kodekal in the Shorapur doab yielded such evidences, which lent support to Allchin's conclusions. While their status as ritual

formations is generally accepted, most models have assumed gradual accumulation over an extended period (e.g. Allchin 1963; Paddayya 1991-92;Korisettar et al. 2001a; Boivin 2004a; Johanson 2004).

Study of Cultural remains in order to reconstruct settlement and subsistence patterns of Southern Neolithic sites

Brief historical development of settlement pattern studies in Archaeology

Gordon R. Willey was the first to introduce settlement pattern studies in Archaeology. He was very much impressed by the work of D.C. Steward, an ethnographer by profession who during World War II observed at different sites the deposits left by Nomadic Indian Bands of Great Basin, Western United States, by following them from place to place. This was the first step for the formation of the concept of settlement pattern studies in Archaeology. Settlement pattern studies aim at obtaining ecological, social and cultural information of ancient societies not from a single site but by studying the remains of the people from a multitude of sites. In other words, settlement pattern is a geographical concept that brings into focus the working relationship between people, their environment and their technology.

Willey, G.R. (1953) was the first to give comprehensive definitions about settlement pattern. According to him the settlement pattern is the study of "the way in which man disposed himself over the landscape on which he lived it is a strategic point for the functional interpretation of archaeological cultures, since they reflect on the natural environment, the level of technology on which builders operated and

various institutions of social interaction and central which the culture maintained".

After Willey has published a monograph on the "Prehistoric settlement patterns in the Viru Valley, Peru" many archaeologists were attracted by Willey's type of work and formulated their own definitions on the settlement pattern studies. Chang, K.C. (1958) described settlement pattern as "the manner in which human settlements are arranged over the landscape in relation to the physiographic, geographic environment" and community patterns as "the manner in which the inhabitants arrange their various structures within the community and their communities within the aggregate.

According to Flannery, K.V. (1976) a settlement pattern, is the pattern of sites on the regional landscape, it is empirically derived from sampling, total survey and is usually studied by counting sites, measuring their sizes and the distances among them and so on".

Vogt, E.E. (1956) defined settlement pattern of the patterned manner in which household and community units are arranged specially over the landscape".

A settlement pattern, according to Trigger, B.C. (1963), is the manner in which people, cultural activities and social institutions are described over the landscape".

Settlement pattern studies are being used as a working model by scholars to identify different activities of ancient people. While Chang, K.C. (1958) tried to identify the social patterns, Mac Neish, R.S. (1970) tried to interpret in the light of the ecosystems. Religious traditions were reconstructed by Sears, W.H. (1961) while Clarke (1968) tried at the interpretation of cultural systems.

Flanner, K.V. (1976) tried to draw out a distinction between settlement pattern and settlement system. According to him settlement pattern is the study of the distribution of sites "on regional landscape whereas the settlement system is the set of rules that generated the pattern in the first place".

According to Rouse, I. (1972) settlement archaeology means the study and reconstruction of cultural life ways and processes of change.

Trigger, B.C. (1968) has identified three levels as the determinants of settlement patterns. Those are:

1. Individual building level: The individual structures are the first determinant factor. The construction of household depends on the environmental conditions, available technology and the status of the individual who proposed to construct it. Nomadic people prefer to have round huts as they are easy to construct and transport. Settled communities on the other hand plan for rectangular permanent

houses with more than one room. The non-availability of the building materials and proper environment makes those people living in deserts prefer tents. On the basis of the dimension and measurement of a house an appropriate estimate can be made about the persons that once occupied the house, the position of rank of the person owning it etc. The scholars who worked in this direction include Chang, K.C. (1958), Trigger, B.C. (1963), Flannery K.V. (1972) and Dhavalikar, M.K. (1977), etc.

2. Community Levels: The assortment of house constructions in an area might give a few clues about the social and economic framework of the community which was occupying them. The mode of construction of the houses also reflects the economy and subsistence pattern of the community. In this direction the scholars who worked include Chang, K.C. (1962), Adam, N.H. (1965), Clark (1972), Flannery K.V. (1976) and Dhavalikar, M.K. (1977, 1978a).

3. Zonal Pattern: Zonal pattern is a geographical concept. The factors that directly or indirectly influence the settlement pattern of any culture include nearness to perennial water supply, fertility of the soil, the availability of raw material, good grazing grounds and the stable environmental conditions to live on etc. in complex societies besides the above said factors, political organization, trade, warfare,

and religion also play a dominant role. Many works that corroborate zonal pattern have come up which include Adam, N.M. (1961), Willey, G.R. (1956), Sanders, W.T. (1965), Flannery K.V. (1969), Raju (1981), Renfrew, C. (1972), Sehl, G.L (1974), Suraj Bhan (1977), Dhavalikar, M.K (1977, 1978), Chitalwala Y,M. (1979), Makhanlal (1984) and Shinde, V. (1984), Nasim Ameer (1981), Lal (1982), Paddyya (1982), Rossehl (1982), Murthi D.B. (1984), David Raju (1985, 1990), Mohaty(1989), Murthy (1989), and Venkata Subbaiah (1992).

The study of settlement pattern requires strenuous and thorough fieldwork and mental thinking. Even then it is not fool proof and there exist a few limitations.

Settlements of the Southern Neolithic found in virtually all of Karnataka, southwestern Andrapradesh, and northern Tamilnadu are associated with the granite hill slops and riverine settings of the region. The sites are small and many seem to be temporary, possibly forest herding camp, with a food economy based on cattle, millets, and pulses. A curious feature of some settlements is the presence of mound of dung with evidence of periodic, large-scale burning (Zeuner 1959; F. R. Allchin1963). There has been a fair amount of excavation at settlements and ash mounds of the southern Neolithic. The Neolithic people living

in the open on the flat terraces made by levelling the tops of the granite hills must have also chosen the natural rock-shelters site like Palavoy, Sanganakallu, Piklihal, Tekkalakota and Paiyyampalli, and so on. Occupation was extended to the slopes and plains at the feet of the hills as at Maski and Brahmagiri. They also lived on the riverbanks as at site like T. Narsipur and Hallur.

There is no clear picture of the plans of Neolithic houses in view of the limited nature of the excavations at the site hitherto dug in the South. Structural remains of wood found at Brahmagiri, Maski, Piklihal, Tekkalakota and Hallur indicate that huts were raised on round wooden posts. At Piklihal, there was evidence of walls of bamboo matting plastered with mud and floors made of clay and dung. At Brahmagiri and Sanganakalu lime was also used in the making of floors. The houses were of square or rectangular plan at Piklihal. Further, here there was evidence of a floor in front of a rock-shelter showing the easiest and simplest way of making houses. At Sanganakallu, the Neolithic habitation was separated from the pre-neolithic occupation as there was evidence of several floors superimposed one upon the other. Recent excavations here by Prof. Sankalia (1965) have revealed the plan of a circular hut supported on wooden posts. Within the house were found remnants of a hearth, a storage pit, a few rubbers and ground stone axes.

The hill dwellers of Tekkalakota settled on flat terraces enclosed by big granite boulders. The enclosed areas provided protection from wild beast and human enemies. The uneven surfaces were filled with reddish murum, silt, rubble and occasional boulders. Walls of mud or clay supported by wooden posts as at other sites were raised right on the murum surface. Two building phases have come to light during excavations. In the first phase, floor was levelled by rubble stones enclosed by circular row of large boulders on which appeared to have stood screens made of split bamboo. The roof of these circular houses was probably conical. Similar circular house plans with bamboo matting were found in phase 2 of the Neolithic period at Hallur.

Palavoy II brought to light only one floor with several circular postholes, which yielded disintegrated wood of Acacia or Dalbergia plant showing their use in house construction. Wood remains of the same species were found at Maski. The postholes suggest a circular to rectangular plan of the house. The floor is made of a pale brown soil mixed with sand. The debris of the layer 10 covering the floor probably fell from the thatched roof while that of layer 9 with clayey soil would be that of walls as at Sanganakallu. There was no evidence of bamboo screen. But several circular to rectangular plans of various sizes of naturally placed boulders were observed on the hill slope and top at

Palavoy. These plans occurring in the form of terraces as at Piklihal confirm the evidence of house plans exposed in the excavations.

4.1. Subsistence Pattern

The systematic and scientific approach towards the reconstruction of pre-historic subsistence patterns is of a recent origin and was first attempted by Clark, J.G.D. (1952) which in due course was given proper attention by scholars like Flannery, K.V. (1969), Vita-Finzi, C. (1978), Vita-Finzi and Higgs, E. (1970), Adam, N.K. (1965), Cohen, M.N. (1977) Jochim, M.A. (1976), Lee, R.B. (1968), Boaerup, K. (1965) etc. Of these Vita-Finzi and Higg's (1970) site catchement analysis is the most important. The site catchments analysis aims at the resource potential of an individual site. The basic theme of the concept is that, the farther the exploitation area is from the settlement, the less it is likely to be exploited, unless and other wise it is productive. In other words, if the area is away from the normal distance (Ex. 5 km) from the site, its exploitation is uneconomical since a considerable time is being wasted to reach the work spot and return to the settlement. Vita-finzi and Higgs have drawn the circles of 1,2,3, 4 and 5 km from a fixed point of the site and found at Mount Carmel that the area within one kilometres from the site was fully (i.e. 100%) exploited, between one km to two km 50% while 2-3 km 33% etc. (Vita-finze and R. Higgs 1970:7).

The model proposed by Vita-finze and Higgs was acknowledged by so many scholars. A closely connected study was conducted by Flannery, K.V. (1968, 1969) on the origins and spread of early agricultural traits on a systematic view. Flannery, K.V. (1968) could successfully highlight various interacting forces that ultimately led to the establishment of agricultural based economies. The study of hunter gathered by Jochim, M.A. (1976) and the study of agricultural exploitation by Chrisholm, M. (1979) are also works of a similar nature.

The studies of the above kind have not yet been popular enough as to become a tangible operational model in the Indian context. However, a beginning was already made in that direction and could be seen in the works of Dhavalikar, M.K. and Possehl, G.L. (1974), Dhavalikar, M.K. (1977, 1983), Possehl (1980), Mahanlal (1982) and Shinde, V. (1983, 1984).

The systematic and scientific reconstruction of the subsistence pattern of South Indian Neolithic is difficult tasks because of the collection of the ecofacts from the Neolithic sites were not proper. However, the available information on the subject indicates that the Neolithic economy was based on mixed economy, i.e., food production and food collection which are again subdivided into the cultivation of

food grains, domestication of animals, hunting, fishing and the collection of edible plant products, etc.

4.2. Food Production

The invention of food production has reaching effects on the life of human beings and since it occurred in Neolithic age, it has attained great importance. The food production is of two types i.e., cultivation of food grains and domestication of animal.

4.3. Archaeological remains

Pecked and Ground Stone Industry

The pecked and ground stone industry forms a significant trait of the Southern Neolithic culture. The artifcats of this industry are made of igneous and metamorphic rocks like basalt/dolerite, diorite, granite, epidote grantie, greenstone, schist, gneiss, quartz, and quartzite. Basalts and dolerites, which occur in the form of dykes, were most commonly used in the manufacture of tools. Sandstone was also occasionally used for making tools.

The techniques of manufacture consist of flaking pecking and grinding. These were employed either individually or in combination in the preparation of a tool.

The Neolithic stone tools is characterized by axes, adzes, wedges, picks, borers, chopper-chopping tools, scrapers, chisels, hammers, sling-stones, rubbers, querns, grooved hammer stones and mace heads or ring stones. At no single site, however, all the types are represented.

Axes from the most common and significant group of tools in the pecked and ground stone industry. They are known from all the sites in South excepting Utnur and Maski. Axes occurred in the Neolithic levels at Palavoy and on the surface of most of the sites in Anantapur and Kurnool districts.

Adze which is an uncommon type is known at Sanganakallu, Brahmagiri, Piklihal and Tekkalakota. No specimens of this type were found in Palavoy II though there are a few in the surface collection from the region.

Chisels are known from Sanganakallu, Piklihal and Tekkalakota but are absent from Palavoy. Objects like rubbing stones, querns, hammer stones and slings are known from all the sites in South India. Mace heads known from several sites from the surface South India.

Blade and Microlithic Industry

The blade industry consists mostly of blades with secondary work. Retouched tools form found from explored and excavated sites of south India, only a small proportion; these include serrated or blunted

back blades, lunates, triangles, trapezes, points, scrapers, etc. these are made of siliceous rocks like chert, chalcedony, jasper, agate, opal and quartz. The industy is particularly common at Brahmagiri, Sanganakallu, Maski, Piklihal, Tekkalakota and Hallur and is present at T. Narsipur, Utnur and Nagarjunakonda as well. The industry is based on the crested guiding ridge technique and is in this respect similar to the blade industry of the chalcolithic culture of the Northern Deccan. At Maski, the blades are of a very large size, obviously due to the nature of the raw material there.

Bone Tools

Bone tools are known from several Neolithic sites, but they are not very common. An awl with a notch at the butt end is known from Sanganakallu and a worked bone point I the upper Neolithic period of Piklihal. From Utnur comes a fragment of bovine long bone ground at one end to form a flattened chisel-like blade. Allchin, thinks it was used for scraping bone marrow. Tekkalakota yielded two chisel ends, one scraper and seven points. Besides, three antlers of wavy horned antelope and deer or stag with perforated branches were possibly used as handles by hunters. Phase 2 at Hallur also brought to light a few bone points.

Palavoy II is rich in bone tools like scrapers, blades, and points. The surface of the site also yielded bone scrappers, a punch and a chisel.

The bone scrapers from Palavoy are made on bovine scapulae and are morphologically similar to stone axes. These are unique finds in the Neolithic Culture of South India.

Grinding Grooves

The evidence to show how the axes were ground, particularly their edges, was first noticed by Foote (1887; 1914: 92, 1916: 87) in the form of rock grooves on the 'North hill' of Bellary town, east of Helalagundi (Halalagondi) in Alur taluk of Kurnool district and at Pullayyagudda in the former Hyderabad state. Similar grooves were found by De Terra (1942) on a quartzite boulder at Burzahom in Kashmir, and later by Subbarao (1949: 144) at Sanganakallu the southern foot of Sanarachamma hill on an exposed boulder in the open fields. At Piklihal, were found at Palavoy as well and it is thought that the tools were manufactured and ground in these grooves at the site itself.

Pottery

Pottery typology is a basic archaeological approach to characterising ancient "cultures" and for building relative chronology. The earliest excavations in South India lead to the identification of grey and red wares as the typical and unifying ceramics of the Southern Neolithic culture (Krishna 1943; Wheeler 1947; Subbarao 1948; Thapar

1957; Allchin 1960, 1961). Other ceramic ware groups were also present, although they played less of a role in unifying the Neolithic sites of South India. Perforated and incised pottery and cooper objects are ubiquitous in the later phase of the Southern Neolithic (mid-second millennium B.C.). However, they have recently been reported from a significantly earlier at Watgal (Deveraj et al. 1995. Blotchy grey wares has been found in the lower levels of several excavated sites in the Malwa Chaclolithic complex as far north as central India and the Kaveri Valley in the south. Blotchy grey pottery and red wares are common to both ashmounds and habitation sites which date from the first half of the third millennium to the first quarter of the second millennium B.C. While the Chalcolithic complex in central India and northern Deccan is well constrained by radiocarbon dates from the late third millennium B.C. through the whole of the second millennium B.C. (Possehl and Rissman 1992; Allchin and Allchin 1997). The typical Neolithic of southern peninsluar India begins early by between 500 and 800 years (for instance Watgal and Utnur in the Raichur Doab). The ceramic industry develops further with the introduction of black-painted red wares that can be compared to the Jorwe wares of Maharashtra, although the assumption that this ceramic styles come from the Jorwe region in the north need to be reconsidered since the the growing body of radiometric evidence points to the priority of these black-painted red

wares in Karantaka and Andhra (cf. Venkatasubbaiah and Kajale 1991; Deveraj et al 1995). Given the chronological priority of the Southern Neolithic over ceramic-using cultures immediately to the north, the possibility that pottery developed independently on the peninsula needs to be seriously considered. It also must be recognised the detailed comparative studies of the fabric and the decorative styles of these black-painted red wares have not been undertaken, so that the extent to which distinct regional groupings and/or interregional influences can be reconstructed is as yet unclear.

In the later Neolithic, wheel-thrown black-and-red wares appears y associated Iron Age.

In the paragraphs that follow brief summaries of the range of ceramic recovered from various sites or regions are given:

Neolithic pottery is mainly handmade, excepting at Maski where wheel made pottery occurred in high proportion. A part of the Piklihal pottery, particularly the A4 and A5 wares of the Upper Neolithic period are said to be turn-table made. The black-and-red ware found with burials in Tekkalakota –II.

The pottery consists of three distinct wares – blotchy grey, dull red and black-on-red wares. It is often divided into several sub-wares on

the basis of surface treatment, technique of manufacture, shape and decoration.

Allchin (1960:23) divides the Piklihal pottery technologically into five groups designated A1, 2, 3, 4 and 5 respectively.

The A1 ware is generally black to grey in colour, but sometimes buff as well. This variety also includes a small proportion of sherds of incised, perforate and surface roughened wares. The surface of this ware is unburnished.

The A2 ware is similar to A1 ware in colour. Its surface is burnished and painted with a post-firing red ochre wash.

The A3 ware bears red, black, chocolate or brown ochreous surfaces, which depend on the slip or dressing applied over them. The ware is both plain and painted.

The A4 ware has grey, buff and mottled colours. The surfaces are fused and burnished.

The A5 ware has grey, buff, olive green and black burnished surfaces approaching black-and-red ware.

The A1 to 3 wares are handmade, while A4 and A5 wares seem to have been made on a turntable. The A1, A2 and A3 wares occur in both lower and upper Neolithic Periods, but are more predominant in the

former. The small percentage of painted sherds in A3 ware is characteristic of only the lower Neolithic period.

The A1 – 3 wares have been found at Utnur (Allchin 1961:2 4). From the total absence of A4 and A5 wares at Utnur, Allchin considers the Utnur Neolithic as equivalent to the lower Neolithic of Piklihal and other contemporary sites in the South.

The grey ware, equivalent to Allchin's A1 to A2 ware, is the most significant ware and is abundant at all sites in South India. It is more predominant in the early than in the late levels of this culture. However, it is regular in all levels of Maski-I. the pale grey ware is sometimes even absent as levels of Maski – I the pale grey ware is sometimes even absent as in phase 2 at Hallur (Nagaraja Rao 1966). In Palavoy II, grey associated wares are in larger proportion in the upper than in the lower levels unlike at other sites. The ware occurs both with and without slip and burnishing.

The dull red ware is the next common ware of the Southern Neolithic culture and has been reported from Sanganakallu – II.2, Maski – I, Nagarjunakonda, Teekalakota-I, Hallur 2 and on the surfaces of several sites in Kurnool district (Sarma 1967: 87-8). The plain A3 red ware from Piklihal and Utnur can well go with this ware. Like the grey ware, this too occurs both with and without burnishing.

The pottery types known at Piklihal comprise shallow dishes or platters; bowls of various sizes and shapes; lipped bowls; lugged bowls; spouted bowls; channel-spouted bowls; vessels of various sizes with narrow, wide, broad and open mouths; bases; handled pots; lids; bell-shaped jars; hollow-footed cups; carinated bowls and legged stands.

Legged stands occur in A3, A4 and A5 wares but more predominantly in A3 ware. Lips, lugs and handles characteristic of A1 to 3 wares are absent in A4 and A5 wares.

The most interesting and significant types are the lipped, spouted and channel-spouted bowls, the handled pots, bell-shaped jars, the legged stands and perforated pots.

A lipped bowl of painted red ware was first found at Patapad in Kurnool district by Robert Bruce Foote (1916:115). Similar bowls have subsequently turned up in coarse grey, dull grey and polished brown–and–black wares in the lowest stratum of Brahmagiri IB (Wheeler 1948:229 and 232); in pale grey ware from Sanganakallu II-1 and -2 (Subbarao 1948); in A1 buff ware from Piklihal lower and upper Neolithic periods (Allchin 1960); in burnished as well as pale grey wares from the earliest levels of Tekkalakota-I (Nagaraja Rao and Malhotra 1965); in coarse grey ware from the Neolithic levels at T. Narsipur (IAR 1961-62:35); from period I at Bainapalli (IAR 1964-

65:57) and in burnished grey ware from surface in Kurnool distict (Sarma 1967). From Palavoy (V.R.Reddy 1968) burnished grey, dull red and painted red wares.

Spouted bowls and vessels are known from Brahmagiri, Nagarjunakonda (IAR 1957-58), T. Narsipur (IAR 1958-59:32), Piklihal upper Neolithic period and Tekkalakota, Palavoy II though the surface of this and a few other sites in the region yielded fragments of tubular spouts made of dull red and grey wares. At Brahamagiri, Piklihal and Tekkalakota these pots have been found in association with burials. However, no such pots or spouts occurred with burials at Palavoy possibly because the dead here were children while at other sites they were adults.

Channel-spouted bowls is reported from T. Narsipur (IAR 1958-59:33) and Piklihal. A single specimen of this type closely parallel to that of Piklihal has been recovered from Palavoy excavations also, the difference between the two being that the Piklihal specimen is in A2 (approaching A5) ware with red ochre band around the edge while that of Palavoy is in painted red ware. Lugged bowls occurred at Piklihal, Sanganakallu and Maski. Cylindrical handles similar to the one from Piklihal have been collected from the surface of a few sites including

Palavoy. Broad handles, ladled handles and a number of looped handles characteristic feature of South India.

Fragments of bowls or vessels with carination at the belly in burnished grey and dull red wares were found on the surface of the site of Velpumadugu and from Palavoy II, Piklihal and Sanganakallu.

The next important type consists of perforated pots. So far only fragments of this type have been recovered from the excavations at Brahmagiri, Maski, Sanganakallu, Piklihal and Tekkalakota. Lids found at Maski and Piklihal have been found on surface and in the excavations at Palavoy.

Flat bases of vessels or cups of Brahmagiri, Piklihal and Utnur have turned up on surface at Palavoy.

Legged stands characteristic of A3, A4 and A5 wares and bell-shaped jars of A1 and A2 wares from piklihal are not known from any other Neolithic sites in South India including Palavoy.

At least five types of decoration occur upon the vessels of various wares in South India. They are 1) impressed, 2) incised, 3) appliqué, 4) perforated and 5) painted.

The first type is a finger-tip impressed decoration usually occurring on the rims of storage jars in single or double rows. It is known from Sanganakallu, Piklihal and Tekkalakota (Nagaraja Rao and

Malhotra 1965: 37). Such decoration has also been found on the rims of storage jars of unburnished grey, unburnished and burnished dull red wares from other sites in South-Western Andhra Pradesh.

Incised decoration in the form of elementary herring bone or crisscross patterns and as irregular incisions on grey and buff-slipped sherds was found at Brahmagiri I culture Palavoy. Similar decoration as vertical, horizontal and oblique lines or as finger-nail incisions on an applied band below the rim is reported throughout Maski I (Thapar 1957 48). At Piklihal the designs are in the form of scratches in horizontal and diagonal bands on A1 ware sherds at at Maski or in herring bone patterns on A2 grey ware sherds as at Brahmagiri. Such decoration has also been found in the form of irregular incisions on sherds of A1 grey-brown ware at Utnur.

Appliqué decoration is rare and is known only from Piklihal and Tekkalakota. At the former site it occurs individually as well as in combination with finger-tip impressions designs. At Palavoy II appliqué decoration is seen alone and in combination with incised and red ochre painted designs.

Perforated decoration is present on the bases of grey and dull red ware pots and is reported from all Neolithic sites in South India. Painted decoration consists of red ochre bands usually found upon rim edges,

neck and shoulders of bowls, globular pots, lipped bowls, etc of burnished grey ware. It occurs in the form of horizontal or vertical bands. This has been reported from all the excavated sites in South India.

Painted Black-on-Red ware

This ware in the form of lipped bowls with paintings in black was first discovered by Robert Bruce Foote (1916: 115) at Patapadu in Kurnool district. Later, Wheeler found some sherds of this ware in Brahmagiri IA. The painted ware is buff or red-slipped. The red-slipped pottery is burnished and salt-glazed. The painting was done after firing with brownish purple coloured ochre. The decorative patterns consists of simple horizontal and vertical bands, crisscross or lattice and highly conventionalized plant patterns. At Sanganakallu, the painted pottery is characteristic of phase II-2. The ware is represented by a small number of shapeless sherds and the designs on them are similar to those of Brahmagiri. The painted red ware from Maski belongs to the lower levels of period I. The painted red ware from Maski belongs to the lower levels of period I. The painted designs in black or chocolate colour were drawn over a red-slipped surface and consists of vertical lines below a horizontal band and oblique lines. Thapar (1957:24) thinks that the painted pottery of Brahmagiri IA and Maski I.

The painted pottery at Piklihal represented by A3 burnished ware occurs in small proportion in the Lower Neolithic period. The designs consist of hortizontal bands, a number of radiating triangles, etc. drawn from a band around the neck of pots. Utnur also yielded painted pottery (more than at Piklihal) of A3 ware from the Lower Neolithic period. A few sherds of painted red ware characterize Tekkalakota II. The types are globular vessels and high-necked jars, which the excavator compares with similar types, form Nevasa and Jorwe. The painted designs are horizontal or vertical bands as at other sites. Nagarajunakonda yielded a solitary painted sherd, and a few sherds are known from period II (chalcolithic) of T. Narsipur and phase 2 (chalcolithic) of Hallur. Painted pottery is thus known I the lower levels of Brahmagiri IA, Maski I, Piklihal and Utnur Lower Neolithic period and Nagarjunakonda. At Sanganakallu, Tekkalakota, Narsipur and Hallur, painted pottery occurred in upper levels. But at all sites its incidence is small and hence it has been thought hat painted pottery at Neolithic sites was derived by trade from the chalcolithic sites of the Northern Deccan.

Several sites around Patapadu in Kurnool and Cuddapah districts of Andhra Pradesh (Sarma 1967:75-94) have yielded painted sherds. The chief type is lipped bowl. Other types include goblet bowls, wine cups and bowls with convex flaring rims, globular jars, and constricted

as well as high-necked vessels – all comparable to similar types of Malwa ware. The designs are geometric and sometimes naturalistic. Sarma thinks that painted pottery along with other relics like copper and gold objects and steatite beads first reached the south as imports form the Indus and Banas Valleys. Later these objects were made indigenously out of the locally available raw material.

Copper Objects

Copper objects are known from the Neolithic sites of Brahmagiri, Maski, Piklihal, Tekkalakota and Hallur. They are, however, scarce in comparison to stone tools. At Brahmagiri, phase IB yielded two bronze objects probably a pin and a ring and two copper objects – a circular rod and a flat axe. At Maski, a solitary copper rod was found in the mid-level of period I. A long copper chisel and two fragments of a copper bowl occurred I the upper levels at Piklihal. At Tekkalakota, a rectangular flat copper axe was recovered from the lower level of phase I and in phase II, several copper objects consisting a spiral, a bent wire, a ring, a nail-head and a non-descript piece were recovered. At Hallur, phase 2 yielded miniature copper axes and fish-hooks. Excepting Tekkalakota (where phase I also yielded copper) copper occurs in small quantities in the late levels of Neolithic culture suggesting that the

knowledge of this metal was acquired by Neolithic people during the latter part of the culture.

At Palavoy, a single copper object, probably a fragment of an arrowhead came from a fairly late Neolithic stratum. None of the other Neolithic sites in the South has yielded a comparable object.

The presence of copper objects at all the Neolithic sites including Palavoy suggests that the Southern Neolithic people were in contact with the contemporary Chalcolithic people of the Northern Deccan.

Ornaments

Objects of ornament mostly I the form of beads figure at all Neolithic sites excepting Utnur. The commonest material is steatite, but beads of shell, terracotta, agate, amethyst, carnelian, chalcedony, coral, paste, argillite, greenstone and bone are also known. Steatite and shell beads occur on all the sites. Terracotta beads occur at Brahmagiri and Hallur while those of agate were found at Brahmgiri and Maski. Maski, Piklihal, Sanganakallu, Tekkalakota and Palvoy yielded carnelian beads. Beads of amethyst, chalcedony, coral and paste have been found at Maski only while those of argillite and greenstone are characteristic of Tekkalakota. Gold and bone beads were found at Hallur alone.

Besides, at Tekkalakota two gold ear ornaments or pendant s were found in the earliest levels of phase I while copper ornaments like spirals and bangles occurred in phase II.

Explorations in Kurnool district (Sarma 1967: 88-9) brought to light a large number of disc-shaped beads of steatite from the sites of Pusalapadu in Giddalur taluk and Ramapuram in Banganpalle taluk. This richness is also reflected in the names of the sites – 'Pusalapadu' (Pusalu = beads; Padu = heap of refuse) and 'Bandipusala Chenu' (meaning 'a field of wheel-shaped beads').

As beads, especially those of steatite, are profuse on the Harappan sites, Allchin (1960:111) thinks that itinerant pedlars brought them to the Deccan Neolithic sites from the Indus Valley. It is, however, possible that steatite beads were locally made as the limestones in Bellary, Anantapur and Kurnool districts are rich in steatite. Even agate and chert could be obtained from the Tungabhadra shingle beds.

4.4. Chronology:

Radiocarbon dates for the Southern Neolithic Culture are available only from six sites. They are given below:

Sites	Radio carbon dates in B.C. for	
	Early levels	Late levels
Utnur	2160 ±150	–
Tekkalakota	1780±105	1540±105
		1615±105
		1610±105
Hallur	1710±105	1030±105
Sanganakallu	1590±110	1585±105
T. Narsipur	1805±110	1495±110
Bainapalli	1485±110	–

In the light of these dates, it can be stated that the south Indian Neolithic Culture flourished between c. 2200 B.C. and c. 1000 B.C. It should, however, be noted that only a solitary date from Utnur takes the lower limit to 2200 B.C. and similarly a single date from Hallur puts the upper limit at 1000 B.C. The bulk of the dates put the Neolithic culture between 1800 and 1500 B.C. Painted pottery was found in the lower level at Utnur having a date of 2200 B.C. while at Sanganakallu, Tekkalakota and T. Narsipur, it was known in the upper levels dated between 1600 and 1500 B.C. copper also occurred in the late levels of

the Neolithic culture at majority of the sites though at Tekkalakota it was found at the beginning of phase. It is thus clear that painted pottery and copper were mostly known to Southern Neolithic people between 1800 and 1500 B.C. the only site that gives an earlier date for painted pottery is Utnur. However, I radiocarbon dating, a cluster of dates is always more reliable than a solitary date and hence the period 1800-1500 B.C. for the Neolithic Culture appears to be a safer dating.

At Palavoy, painted pottery occurred in the lower as well as upper levels but was more common in the upper than in the lower. Besides, the upper level also yielded a copper object as well. Taking the common horizon and dates of this evidence from other sites in South, we tentatively may date the Neolithic Culture at Palavoy between 1800 and 1500 B.C. the more precise dating will be possible only when radiocarbon dates are received.

To sum up, the Neolithic Cutlrue of South-Western Andhra Pradsh closely corresponds to its counterparts in South India. However, two features of Palavoy II stand up distinctly. They are (1) the bone scrapers which recall the ground stone axes and are absent at other excavated sites, and (2) the painted pottery which is of local origin unlike at other sites in the South. The painted pottery may be correlate to that of Eastern Andhra Pradesh, but the types like goblet-bowls, wine

cups and bowls with convex flaring sides and featureless rims (Sarma 1967:91-2) are absent in the painted red ware of Palavoy. Even the white or cream-slipped ware is unknown at Palavoy.

4.5. Biological remains

Disposal of the Dead

Skeletal biology of neolithic burial remains from the excavation of T. Narasipur was carried out by K.C. Malhotra (1997). In his report of the skeletal analysis Malhotra summarised the evidence for the existence of different skeletal series in the Southern Neolithic burial assemblages in terms of 'races' and emphsised the presence of two distinct racial types

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however, varied from skeleton to skelton. The Australoid population being native this region (autochthonous) and the Mediterranean the immigrant population, tending to show gradual asimailation with the autochthonous population.

At Brahmagiri (Sarkar 1960: 24) the single child skeleton could not be definitively ascribed to either of these but it betrayed characterisitcs similar to the Australoid type. The Piklihal evidence (2: a male and a female) was more in favour of the Mediterranean. At Tekkalakota 5 idnividuals (3 intact: 2 females, 3 males), Nagarjunakonda 4 individuals (3 males and 1 female). The evidence from T. Narsipur conforms to that from these sties, and the majority reveal Mediterranean features.i) Proto-australoid or Autsraloid and (ii) Mediterranean, and evidence for Negrito and Veddoid racial features was absent. Malhotra found that at some sites the racial element was either completely Proto-australoid or Mediterranean and in some the skeletons betrayed a combination of these features, this admixture, however, varied from skeleton to skelton. The Australoid population being native this region (autochthonous) and the Mediterranean the immigrant population, tending to show gradual asimailation with the autochthonous population.

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Floral and Faunal Evidences

The investigations into the floral remains of the South Indian Neolithic where excavations were conducted did not focus much on the careful collection, treatment, identification, analysis and interpretation of the cereal grains as may have been left in the layers of occupation. The floatation technique which is used in the recently excavated sites like Inamgoen (Kajale 1979) was not popular at that time and hence the traditional and conventional methods were used to pick up the floral remains which did not yield the required data. Hence, any ambitious plan to reconstruct the subsistence pattern prevalent during the Neolithic period falls short of tangible material data. Only three sites viz., Hallur, Tekkelakota and Paiyampalle have preserved the direct evidences for the practice of agriculture. Hallur has provided the evidences for Ragi

(Eleusine coracana) while Tekkelakota has yielded the remains of horsegram (Dolichoa biflorus). Both these species besides the green gram (Phaseolus radiatus) was also found at Paiyampalle in Tamilnadu. Recent archaeobotanical research has provided a picture of recurrent staples and occasional secondary crops of the Southern Neolithic (Fuller et al., 2001a, 2001b, 2004; Fuller, 2003b, 2006). The staples include two native species of millets (Brachiaria ramosa and Setaria verticillata) and two pulses (Vigna radiata and Macrotyloma uniflorum). What is known of the ecology of these species suggests that domestication occurred in a Dry Deciduous woodland zone that interfingered with savannah scrub (favoured by Macrotyloma uniflorum) and moist deciduous woodland (favoured by Vigna radiata). The millets would have occurred patchily throughout these zones. While this zone has been argued to be on the inside of the Western Ghats (Fuller and Korisettar, 2004), patches along the Eastern Ghats between the Krishna and the Godavari river are now favored on the basis of recently gathered data on wild progenitors of the Vigna pulses (Fuller and Harvey, 2006). When climatic conditions were wetter during much of the early and mid-Holocene we would expect the Moist Deciduous zones to have expanded (especially eastwards towards the central peninsula, and for the savannah/scrub zones to have been reduced by impinging dry deciduous woodlands (Fuller and Korisettar, 2004). Some of the areas that are today Dry Deciduous forests with a

significant teak (Tectona grandis) element that occur in the hills of the eastern peninsula (Eastern Ghats) would have been Moist Deciduous in character. It is such forests where we might expect former extensions of the wild mungbean, from which domestication could have occurred.

Bones of cattle, sheep and goats, swine, dog and horse recovered from various sites show that domestication was the mainstay of the economy. Most of these bones particularly of cattle are charred and show chopping and splitting marks on their surfaces. Cattle must have been domesticated both for their milk and meat.

The principal animal species was cow/bull (Bos indicus) known from all the Neolithic settlements. Buffalo (Bos bubalis) has been reported from Maski and Nagarjunakonda only. Sheep (OVis Vignei) and goats (Capra hircus aegagrus) were common at all the sites; only the former species was absent at Utnur and the latter at Tekkalakota. No amimal remains were found at Brahmagiri but the early stratum of period IB yielded an unbaked, roughly modelled animal figurine of pig or sheep (?).

Swine, dog and horse were known to Hallur people alone. Some other animals comprise small vertebrates like tortoise form Maski, Piklihal, Utnur and Tekkalakota; rats (Rattus rattus) and invertebrates like freshwater mussels (Parreyssai sp.) from Maski and Tekkalakota

and snails from Maski and Piklihal. Punctured decorations of a snake and a peacock on a lid from Tekkalakota indicate that these animals were also known to Neolithic people. Such small animals must have formed a subsidiary item of food of the people of this culture.

Wild species comprise wavy horned antelope from Tekkalakota and Hallur, and stags or deer form Tekkalakota only. These animals were apparently hunted for their meat. The hunting of these fauna was presumably done by bow and arrow and stone missiles. Fishing is evidenced by the finding of copper fish-hooks at Tekkalakota and Hallur.

Lithic assemblage from Southern Neolithic sites.

5.1. Brief account on the study of stone tools from Neolithic period.

The Southern Neolithic stone tool technology is made up of two lithic industries; pecked and ground tools, and blade industry. Edge tools and non-edge tools characterize the former industry. The edge-tool types are axes, adzes, chisels, fabricators, flake tools, chopping tools and the non-edge tools include hammer stones, rubber stones, grinders, mullers, palettes, querns, sling stones, ring stones, anvils and by-product flakes. Of all the implement types, axes form the most common and significant group of tools in the industry. The techniques employed in their manufacture are identical to the various processes of flaking, pecking and grinding described by Allchin (1957:321-35). The South Indian Neolithic sites have revealed the use of a variety of rocks such as basalt, dolerite, granite, epidiorite, greenstone, gneiss, schist, quartz and quartzite.

The blade industry is based on the crested guiding ridge technique. It is composed of finished and simple artefacts divided into three main groups-flakes, blades and cores. The raw materials used in the order of frequency are chert, chalcedony, agate and quartzite. Chert is the main medium employed Neolithic sites of South India. The main tool types include long and short blades, retouched and backed blades,

scrapers, lunets, etc. all these types are known from all excavated and explored sits of Neolithic in South India.

Raw Materials

The principal raw materials utilized for the preparation of the ground stone tools include a range of igneous, metamorphic and sedimentary rocks. The igneous rocks which occur in the form of dykes, sills etc., include basic rocks such as fine grained basalt, and medium grained dolerites as well as acidic rocks such as granites, charnokites etc. The metamorphic rocks mostly comprised of micaecous schists, granite gneisses and quartzite's while the sedimentary rocks includes sandstone etc. Lumps of vein quartz have also been exploited for using them as hammers. The edge ground tools were invariably prepared on igneous rocks and rarely on metamorphic rocks as they were chosen for their hardness, high densities, durability and local availability. The non-edge ground tools on the other head were prepared on metamorphic rocks and occasionally on sandstones too.

Dolerite, basalt and charnokites are derived from dykes, which cut across the granetoid and schistose gneissic formations while the quartzite and other rocks are exploited from the Cuddapah and Kurnool formations. In the adjacent areas of South Western Andhra Pradesh, Raichur and Bellari doab of Karnataka, the principal raw materials used

for the fabrication of edge tools were dolerite and basalt while the non-edge ground tools were usually prepared on coarser rocks such as quartz, quartzite, sandstone epidotic granite, granite etc. (Reddy, V.R. 1978:4).

For microlith raw material used as Chert, Chalcedony, jasper, agate and carnelian of the cry-ptocrystalline form, and quartz and rock crystal of the crystalline form, both of the silica group, constitute the chief raw materials used for the preparation tools in this industry; though a few artifacts of igneous and metamorphic rocks are also met with.

Technology

The techniques used for the fabrication of the ground stone tools were discussed time and again by different scholars. Allchin, F.R. (1960:85-86) and Reddy, V.R. (1978:43-45) recognized that there were 3 basic techniques such as flaking, pecking and grinding employed in the preparation of ground stone tools of the 3 techniques flaking was already known while pecking and grinding were introduced for the first time during Neolithic times (Mc. Carthy, F.D.: 1949).

Foote, R.B. (1916:85) observed 4 stages in the preparation of ground stone tools such as flaking, pecking, grinding and polishing. Subba Rao, B. (1949:143-44) and Sankalia, H.D. (1961:79-82) retained

the four-stage preparation of ground stone tools proposed by Foote. Allchin, F.R. (1957:323) on the other hand, proposed 5 stages such as rough (primary) flaking, fine (secondary) flaking, pecking, grinding and overall grinding. If we consider polishing of Foote and overall grinding of Allchin are one and the same, the latter's second stage i.e., fine (secondary) flaking is an extra stage. Reddy, V.R. (1978:45) failed to realize the difference between the different techniques and stages in the preparation of edge ground tools and hence he clubbed both of them under one category. In this context, it may be observed that not all the specimens were prepared into tools following all the 3 techniques in combination. The techniques were employed for different specimens depending upon the specific requirement. A few tabular blocks already having the required shape could be converted into an edge tool by simple grinding at the edge. Similarly some other tools were pecked and ground and a few more were flaked and ground. Only in rare occasions all these 3 techniques were used in combination on a single specimen. After all, preparing a stone tool is a laborious process and requires a lot of time and energy and hence whenever there is a possibility of avoiding any technique, the Neolithic folk of South India did not hesitate to do so.

Flaking was employed to give a rough shape to the stone by direct percussion method. Spheroid, discoid or an elliptical hand hammers

were the probable tools employed for the purpose. Pecking was resorted to for removing angularities and projections produced during flaking. Allchin, F.R. (1957:323) suggested discoid or cylindrical hammers as the probable tools utilized for this purpose. Grinding was done in a specially made groove or on a flat stone using sand and water. The lustrous shining on the tools might have been obtained by applying grease or oily substance. (Sankalia, H.D.1964:80).

5.2. Typological Classification of ground stone tools

The typological classification of ground stone tools of South Indian Neolithic was first attempted by Foote, R.R. (1916:20-21). He recognized two basic artifact types on the basis of the technique and shape such as ground and polished objected and unpolished artefacts. Among the polished stone objects he recognized 40 groups, and among the unpolished artefacts 25 groups. Besides these, he divided celts in 12 types. Chisels into 6 types and axe hammers into 2 types etc. Though the attempt made by Foote was first of its kind and deserves appreciation, the criteria he adopted divididing the sub-groups and types through the shape of butt, blade, thickness etc., have created confusion and ambiguity. Later on Subba Rao, B. (1948:33) recongised 10 types among the axes by taking into consideration the external form and such other features including sections across the butt. However, he failed to

realize the functional utility of the tools and hence included axe hammers, adzes and chisels in axe group (Reddy, V.R. 1978:45). The classification of Worman, E.C. (1949:180-201) and Seshadri M. (1956:54) also carries similar drawbacks. Allchin, F.R. (1957, 328-332; 1962; 311-14) gave more emphasis on the functional aspect of the ground stone tools and classified the Neolithic stone artefacts of Karnataka into 5 major groups such as edge tools, points, rubbers, hammers and miscellenous, which were again divided into sub-groups. Based on the taxonomy proposed by Allchin, the present writer classified the whole lot of ground stone artefacts into two major divisions such as edge tools and non-edge tools. The edge tools are basically cutting implements, which include the axes, adzes, chisels, and picks and non-ground edge tools such as flakes, flake tools etc. The non-edge ground tools are those that are meant for domestic use such as hammers, rubbers and saddle querns and non-domestic equipment such as sling stones and mace-heads etc.

Microliths from Neolithic period

The blade and microlithic industry constitutes another important feature next to ground stone tools in the Neolithic culture. Limestone, chert, chalcedony, agate, and quartzite of the siliceous, sub-crystalline

and cyrpto-crystalline kinds are the raw-materials used for manufacturing of tools of this industry.

In addition to ground stone tools, blade and microlithic flake tools were an important part of the southern Neolithic technology. These tools derived from an older, long-lasting and widespread technological tradition that spanned most of the Indian peninsula, south of the Narmada River, during the Microlithic/Mesolithic and the succeeding Neolithic/Chalcolithic periods (Gordon 1950; Todd 1950; Wheeler 1948:249; Subbarao 1955; Seshdri 1956; Fairservis 1971: 98-99,329; B.Allchin1977; Allchin and Allchin 1974b; 1982: ch4; cf. Ansari 1988). In general there is rather poor for the Mesolithic period that precedes the southern neolithic. Seshadri (1956) plots number sites throughout the state of Karnataka, while some thirteen sites without pottery, both with microlithic blades, flakes, and cores, were reported from the Anatapur district (Rami Reddy 1978: 17-20), and in the northern Cuddapah district (Venkatasubbaiah 1992). But there has been no systematic survey that might recognise and map such sites. None of these sites has ever been excavated and there is thus little understanding of the nature of occupations, the full range of tool types.

A few southern neolithic sites have suggestive evidence that pre-ceramic, microlithic habitation preceded the neolithic settlements, as

defined on the basis of ceramics, and microlith-using groups co-existed with the ceramic neolithic. The recent excavations at Watgal have revealed a sparse presence of microliths in a aceramic horizon beneath the clearly neolithic levels of the site (Devaraj *et al.* 1995). This evidence is similar to that reported by Subbarao (1948) from the lowest levels of his excavation at Sanganakallu, where microliths accompany the 'pre-neolithic flake'dolerite finds (cf. Sankalia 1969). At Brahmagiri, surface finds of microliths distinct from those seen within the neolithic excavations hint at an earlier phase at this site as well (Seshadri 1956). In addition, some sites on the south bank of the Tungabhadra suggest interchange, or general contemporaneity, between groups. The site of Gurzala where microlithic assemblages were collected by several archaeologists (Foote 1916; Rami Reddy 1978: 18). A few remarks are called for regarding the differences and similarities between the Mesolithic industry and the Neolithic blade industry. First, typologically both industries are more or less similar except a few tool types, which are not represented in the blade industry of Neolithic culture i.e., knives, pen-knives, awls, round and concave or hollow scrapers. Secondly, crested guide ridge technique represented in the Neolithic blade industry is lacking in the Mesolithic industry. Thirdly, fluted cores of the Neolithic assemblage have commonly faceted platforms, while their Mesolithic counterparts are unaffected. Fourthly,

the artefactual assemblages of the Mesolithic industry are homogenous, whereas the Neolithic assemblages are heterogeneous in character. Fifthly, there is a gradual decrease in the percentage of microlithic types like backed blades, lunates and crescentic points in the Neolithic industry and this suggests replacement of hunting-gathering economy by one based on food-production. Finally, in the Mesolithic culture limestone, chert, chalcedony, agate, quartz, quartzite and jasper were used, whereas in the Neolithic, use is restricted to limestone, chert, chalcedony, agate and quartzite and there is also a difference in respect of colour of raw-material.

Edge tools

Axe from Neolithic context The most important groups of Neolithic tools are the axes. The axe with medial ground edge, with generally triangular form and curved blade, and an oval or lenticular medium section. Full grinding is usually reserved for small, flattish axes, and pecking for larger tools from suitable raw material. The shape of axes is variable (Foote, 1916; F.R. Allchin, 1957). In south India the most common form is subtriangular with narrow, rounded or straight butts and ovoid or lenticular cross-section. These may be ground all over or dressed all over and ground only at the edge. The commonest axe form is that often spoken of as pointed-butt axes.

Hafting of axe. We have no direct evidence as to how the axes were used by their makers or owners. They could either be held in naked hand or were hafted into some kind of handle and then used. Probably large axes were used by free hand because of their size and heaviness. Axes of medium and small size must have been fitted in shafts and used. But Seshadri (1956:56) thinks that big axes could have been hafted and used.

Since no perforated axes have been found in India so far nor any material evidence showing the method of hafting, it is not possible to reconstruct the same accurately. Coghlan (1943) postulates a number of hafting methods for the European axes of which his 'club' haft and 'slot' halft methods suit the pointed butt axes of this region. Foote (1916:86) also suggests the 'club' haft method for the Indian axes. Subbarao (1949: 152-3) wrongly attempted to apply the 'spear headed' type of hafting suggested by Foote (1916:173) for palaeoliths. Axes with plano-convex section would have been hafted adze-wise where the blade lies at right angles to the halft. Subbarao (1949), who calls such axes 'shoe-last' celts thought that they were hafted in adze-wise fashion.

Adzes. An adze according to Coghlan (1943:29) is "a tool for chipping or slicing away the surface of the wood. The cutting edge stands transversely, that is, at right angles to the handle. Its level is ground on

the inner face only, while the entire outer face is slightly rounded". Patrie (1917:5) was the first to define adze and it was later adopted by Childe (1930: 60-61) and others. It differs from axe in having a bevelled, central edge.

As the occurrence of adze-blades is very rare in this region and as well in the Deccan, no remarkable difference can be seen in the axe and adze-blades. Many of the unequally ground axes with a Plano-convex cross section are quite suitable for being hafted and used adze wise. Adzes are common on the Neolithic sites in Assam, Yunnan and South East Asia. Dani (1960:47-8) distinguishes them as faceted tools. According to him, these are multipurpose tools. In South East Asia these are called "quadrangular adzes" (Heine Geldern 1928).

In Peninsular India, adzes were first reported by Foote (1916:124) He found a solitary specimen from the Muttugallu Neolithic site in the present district of Raichur, and identified it as the "polynesian type", utilized in agricultural activities. Foote (1916: 20-21) recognized adzes into two types, a short and a long one. His find belonged to the latter type. Wheeler (1947-48: 249) found a specimen of adze in the late phase of the Brahmagiri stone axe culture. Later, Subbarao (1949: 149) illustrated two specimens from Sanganakal, one of them is broken towards the butt while the other does not show any bevel at all. Allchin

(1960:89) also records a single specimen from Piklihal which he describes as having been ground unequally on the upper and lower faces of the working edge. Nagaraja Rao and Mahlhotra (1965:50-1) illustrate two doubtful specimens from Tekkalakota. Rami Reddy. V (1968) adzes, comprising four specimens, come from three sites, one each from Adhoni East and Velpumadugu, and two from Hulikal. All the four, made on natural flakes, are of triangular shape excepting the broken one which could be rectangular. Three specimens are made on fine and medium grained dolerites while the fourth one from Adoni East, which is lightly patinated, is of dolerite/granodiorite.

Chisels

Chisels are narrow elongated axes with ground edge which may be straight or convex. They are the actual prototypes of the metal chisels employed in carpentry. Foote (1916:21), who classified chisels into six types, did not make any distinction between these and picks. His type-6 chisels are infact what we have called picks. Chisels thus differ from picks in not possessing a pointed working edge and long body.

Chisels though of rare occurrence have been found at a number of sites. Foote (1916:200, pl. 6) was the first to pick up chisels from the south, particularly in the districts of Kurnool, Anantapur and Bellary. Later on, Subbarao (1949: 120) found them in good numbers in his

excavations and on the surface on Sanarasamma hill near Bellary. Allchin (1960: 89-90) illustrates two specimens from Piklihal. Recently Nagaraja Rao and Malhotra's (1965: 60) work at Tekkalakota added only two specimens of this type.

Burkitt (1926:106) traces the orgin of chisel form from the narrow elongated celt-form. These tools with their truncated bioconvex business edges aremore akin to wedges than to celts. Chisels like wedges besides splitting wood might have also been used in cutting operations.

Picks

Picks are rough, irregular tools, made almost only by chipping, with narrow sharp working ends and blunt ends suitable for use with wooden mallet.Probably in some case these were used also as cold chisels. They might have been fitted into wood or bamboo as many of them are bruised in the middle along the long axis and some them have their high surfaces ground due to pressure.

Fabricators

According to Subbarao (1948:39), a fabricator is a rough, irregular, cylindrical tool blunted at both the ends. It is almost a "stone finger" which might have been used for a variety of purposes and is very useful in the manufacture of axes, etc.

Flake Tools

Flake tools were detached from nodules in the process of manufacturing pecked and ground tools. These invariably consist of bulb and platforms. These were converted into tools secondary working. They show different shapes: oval, discoidal, triangular and squarish.

Chopper-Chopping tools

Choppers as well as chopping tools are core implements usually made on pebble or angular chunks of rock. The difference between the two types is that the former are unifacially worked tools, while the latter are bifacially flaked, the flaking in both cases extending along one side or end. Further, in choppers the cutting edge is steep convex or straight prepared by "free" flaking, while in chopping tools it is jagged, wavy resulted due to alternate flaking. Both the types are heavy and massive; and were utilized in chopping purposes. When the choppers are small in size Movius (1948:350) calls them scrapers.

Chopper-chopping tools are characteristic of early and middle Stone Age cultures but they persist in small numbers in later cultures as well.

The technique involved in making these tools consists of anvil or block-on-block technique as a result of which deep flake scars are produced on the surface of majority of the specimens. Sometimes

controlled or step flaking is also employed. Both these techniques are found in the present collection of choppers. In making chopping tools the technique of direct percussion of alternate flaking is employed as a consequence of which a zigzag, wavy cutting edge is produced.

Non edge tools

Rubbing Stones

Foote, R.B. (1916:20) identified rubbing stones as mealing stones and classified the specimens collected by him into flat rubbers and rounded rubbers. Allchin, F.R. (1957:327) classified them as rubber and discoid rubbers. According to him the former is Foote`s "corn crushers" where as the latter "mealing stones", Sankalia, H.D. (1964:87-88) considered rubbing stones as mullers and plano-convex mullers.

Rubbing stones are those, which are used for grinding and pounding purposes. Reddy, V.R. calls these tools domestic tools while Nancy,K.(1977)considered them as food processing equipments.

The shape is spheroid rubbers discoid rubber, oval rubbers and oblong rubbers are common in south Indian Neolithics.

Mace Heads or Ring Stone.

Mace heads are thick massive circular stones with a well-drilled central hole. Their surface are some time pecked and ground.The central hole was pecked or drilled alternately from both surfaces and is of 2 to 3 cm.diameter.The width of the hole narrows down from the surface to the centre. Their use as weights for digging sticks suggests that they were primitive agricultural implements. Their association with agricultural operations has been further corroborated by Oakley (1956:33) who reports that the Bushmen of South Africa chiefly utilised the perforated stones as weights for digging sticks. Sankalia (1964:86) thinks that these might have also been used as mace heads.

Hammer Stone

Foote, R.B. (1916:20) on the basis of technique and probable function has recognised several sub types in hammer stones. Allchin, F.R. (1957:327) divided hammer stone into three groups such as 1) Spheroid and discoid hand hammers, 2) Cylindrical hand hammers and 3) Axe hammer (or pestles) and grooved hammer stones. However, Reddy, V.R. (1978:61) raised objection for keeping axe hammer in hammer group in view of their "distinctive origin and function", and hence, he kept the axe hammers in a separate group. In this connection, it may be mentioned that in the choice of raw material, the technique of

preparation and morphological features, there occur differences among true hammers and axe hammers but functionally both are one and the same.

Axe Hammer

The term `axe-hammer` is applied to axes whose cutting edge due to prolonged utilisation, ceased to serve the purpose of an axe and which where, therefore, employed as hammers. They differ from the true hammers in having the shape and technology of the axes though functionally they are identical with hammers. It is because of their function that they are grouped as hammers, though some scholars (Subbarao 1949:148) have treated them in the axe-category. Foote (1916:20-1), however, considered these implements as a separate type. He classified two types of axe hammer 1) axe-hammer with a long narrow body, and 2) axe-hammers with short thick broad body. He regarded shape and size as the criteria for the classification.

Sling stones.

These are perfectly spherical in shape except a few whose surfaces are peeled off because of the nature of the raw material or use. The absence of battering marks indicates that they were the final products of the process involved in the making of hammer stones with a different function. Foote (1916) suggested that these stones were used

for hunting because of their small size. Even today, such spherical balls are used as missiles or throwing stones to drive away birds from crops. But Banerjee (Sankalia et.al. 1958:240-1: 1960:476-7) and Ansari (Deo and Ansari 1965:134,136) thought similar objects were used as weights at Navdatoli, Maheshwar, Nevasa and Chandoli.

Marcoliths Saddle Querns.

The saddle querns derive their name from their appearance to the riding saddles. Querns were used for grinding and pounding grain and other cereals. They are rectangular, squire and less frequently round in shape and are made out of huge granite boulders. Foote (1916:20) who gave the name `mealing troughs` to these divided them into two types- deep and shallow querns. These artefacts have been common from the neolithic into recent times.

5.3. Functional Analysis of Axes

Very little information is available on the functional aspect of the ground stone tools (Lee Roux 1978:44). In Indian context in general and South Indian Neolithic in particular, the studies leading to the functional aspect of the ground stone tools are almost nil. All the efforts of the earlier scholars were basically aimed at the morphological and metrical descriptions of ground stone tools such as length, breadth, thickness, cross-section and weight etc. as studies relating to the application of

ethnographic data and understanding the lithic concentrations against their behaviour patterns were still at infancy, the Neolithic tool kit could not receive hitherto a proper behavioural assessment against their geo-eco settings underlying the economic pursuits.

Foote, R.B. (1916:173), Subba Rao, B. (1949:152-53) and Seshadri, M. (1956:56) have tried to provide probable hafting methods of South Indian neoliths on the basis of the studies conducted by Coghlan, J.H. (1943:27-55). Foote and Subba Rao suggested that elongated ground stone axe could have been fixed to wooden hafts, in "Club Headed haft" (fitting an axe into a piece of perforated wood or antler) (Subba Rao, B. 1948) or in `slot haft` (inserting an axe in wooden slot and trying it with fibre or other binding material). `Knee shaft haft` an other hafting method (Subba Rao, 1948) was suitable for hafting adzes and `shoe-last` celts. The presence of the lustrous shine near the butt and mid portions of the specimen is taken as the evidence for hafting. In this context, Subba Rao suggested that the shining formed on the axe near the butt and mid portion is not due to grinding but because of the rupture of the wooden haft at the time of fixing and also during use.

Subba Rao, B. (1948: 31-35) suggested probable functional aspects of the ground stone tools. According to him axe is to fell the

trees or split or break the wood, adzes for dressing the wood, chisel for cutting slots in the wood, picks for digging, `shoelast celts` for tilling or loosening the soil similar to a plough share.

5.4. The shape and position of the blade:

One of the criteria used by the earlier scholars to classify the ground stone tools into different varieties is the shape and position of the blade. According to Allchin, F.R. (1957:328) "A median blade is agreed to be an axe blade while an eccentrically set or bevelled blade is termed as adze blade". In this context, the functions with which the axe blade and adze blade were connected are worth investigating. If an axe is at operation, the mechanical force exerted on it will centrally project along a linear direction on the object since it has a median edge. The extent and depth of penetration differs from specimen to specimen depending on the acuteness of the edge angle. The adze on the other hand, is prepared with levelled edge and Plano-convex cross-section, consequent to which the weight of the specimen disperses across the bulging portion of the specimen. The force of impact exerted on the object in such cases never projects centrally, but diffuses laterally.

6.1. Study of Raw Material

The varieties of stone utilized by the prehistoric inhabitants of the Sanganakallu-Kupgal area include granite, epidote granite, greenstone, quartz, siliceous breccia, hornblende schist, steatite, slate purple, quartzite, hematite jasper, hematite schist, agate, carnelian, chert and local clays. The use of these varieties of rocks was also noted by Foote (1895). While granite, epidote granite, gneiss, and quartz can be sourced to the immediate neighborhoods of the sites, other types of stone appear to have been obtained from the Sandur greenstone belt formation. This belt lies to the west of the Sanganakallu-Kupgal site complex, which is just one of a series of Neolithic sites located at a radial distance of 10-15 km from the belt.

The Sandur greenstone belt is best known today for its iron ore and manganese deposits, but it also contains a significant storage area of volcanic clastics, metamorphosed sedimentary and crypto-crystalline silica minerals like jasper, agate, and chert. The belt is composed of six different formations. The Deogiri Formation contains orthoquatzites, limestone and chert, while the Raman Mala Formation possesses banded ferruginous cherts (including banded iron foramations). The banded ferruginous chert formations are host to deposits of secondary haematite. The Donimalai Formation is chiefly composed of volcanic

and sedimentary rocks, and banded chert formations are common, ranging in thickness from 1-100 m. These include hematite-enriched types, magnetite, jasper, and pyrite-rich cherts, and non-ferruginous cherts, orthoquartzites and phyllite are also common. The Talur Formation is largely made up of metabasalts, though intercalations of banded chert, siliceous chloritic schist, and rhyolitic tuff are also common. The Vibhutigudda Formation, the youngest formation, includes all the above mentioned silica types.

The dolerite dyke which intrudes into the granites occurs in the form of rounded boulders and angular slabs. These slabs are due to the extensive joints and beddings that occur during the formation of the dyke and are mostly fine grained. It can be noted that these slabs sometimes weather in the form of cobbles and pebbles but these are much lighter in weight. The decompositions of the coarse grained dolerite dyke also resulted in cobbles and pebbles which are mostly used as hammer stones because of their weight and hardness. These angular slabs were chosen because they are fine grained and their angular shape could be easily made into axes and chisels. Most of the Neolithic axes and chisels found during exploration and excavation were on these slabs and only the smaller axes were made from flakes removed from cobbles

and pebbles. Almost all the chisels were made from these slabs while the adzes were usually made from flakes.

In addition to the chert bladelet industry, a number of quartz flakes were recovered throughout the occupation levels, but particularly the earliest phase of occupation at Sannarachamma from which no chert artefacts were recovered and quartz artefacts were numerous. The distribution of these raw material types is striking when quantified stratigraphically. The quartz industry is flake-based, although there are a few bladelets, some of which have been modified into lunates. Thus it appears that quartz was used initially as a raw material for the lithic industry, to be replaced by chert.

Hiregudda, the largest among the complex of hills, with its abundant dolerite, was a location for significant production of dolerite tools, at least some of which were finely finished as ground and polished axes. Foote (1916) has already identified this site as a "factory" for axe production, and its importance as a centre for production was further discussed by Allchin (1957) and reviewed in Korisettar et al. (2001a). Axe production, as indicated above, appears to have focused on specific localities on Hiregudda, and a large workshop area has been identified in Area A. As indicated, there is some evidence also for spatial segregation of axe production steps, with initial roughing out taking

place at quarry sites prior to further shaping in Area A. While some grinding of axes was carried out in Area A, other larger-scale axe grinding localities have been found away from the area, and particularly at the base of Sannarachamma hill.

6.2. Analysis of the lithic artefacts from Sanganakallu

Hiregudda site was sub divided into different areas namely-HGD, Area-A, B, C, D, E, F and J. Prior to area designation, it was referred to as the 'Lithics Plateau' due to the large quantity of lithic artefacts visible on the surface. From these areas lithic artefacts were collected from Area-A, B, C, D and J, where as other areas did not yield any lithic artefacts. From these areas (A, B, C, D and J) small scale excavation was conducted in order to collect the lithic artefacts from stratified layers. These excavations yielded thousands of artefacts, which was very difficult to analysis. In order to reconstruct the reduction sequence employed for manufacturing bifacial edge-ground stone axes at Hiregudda, it was first necessary to stratify the assemblage into discrete technological types. Each of these technological types was inferred to correspond to a particular stage in the manufacture of an axe: from the initial reduction of raw nodules, to early and late stage bifacial thinning and contouring, and to any subsequent modifications such as reworking the ground edge by percussion. The most informative approaches,

artefact conjoining and detailed recording of metrical attributes of artefacts, can be particularly time-consuming procedures and it was necessary to adopt more expedient methods. It was felt that by placing greatest analytical emphasis on detailed examination of formed objects, or stones with pieces detached from them, an effective solution to our problem could be reached. Diacritical analysis of flake scar overlap on formed objects allows the analyst to formulate a set of working assumptions about the range of morphological attributes one might expect to find on individual debitage specimens produced during specific stages of reduction (Moore 2000a, 2000b, 2003a, 2003b, 2003c, 2004). The use of this analytical method enabled the rapid sorting of individual debitage specimens into morphologically distinct types based on observation of certain formal attributes of the artefacts; such as maximum linear dimensions of flakes, amount of cortex present, dorsal flake scar complexity, and so on. This provided a broad but on the other hand informative level of insight into the overall technological organisation of the industry. For the same reason, sampling method was adopted and which was adopted is given below.

Detailed analysis in this the lithic artefacts were analyzed in a detailed manner. In this type of analysis the artefacts were analyzed on the basis of techno-typologically. Where debitages were divided into

complete and broken flakes broadly. Complete flakes were sub-divided into various sub-divisions like early reduction flakes, bifacial thinning flakes and late bifacial thinning flakes, this sub-division were on the basis technology. Formed objects were also.

Using these methods, a representative sample of the dolerite assemblage was sorted into the debitage and formed object types listed in Table 1. Some 943,000 dolerite artefacts from stratigraphic contexts across Feature 1 and Trench 1 in Area A, Area B, Area C, and Area D, were roughly sorted and catalogued. A sample of artefacts from each of these contexts, comprising 167,469 artefacts in total, were sorted into discrete technological categories and analysed.

Area A features a particularly heavy surface scatter of early and late stage dolerite bifacial axe manufacturing debris, including axe blanks and axes. It has been extensively modified by recent sediment mining and commercial granite quarrying activities, which have destroyed part of the area, and exposed strata bearing thick deposits of similarly flaked dolerite material. A stone-lined circular structure (labelled Feature 1) located on the northeast side of Area A has been the focus of intensive archaeological investigation. Feature 1 measure approximately 7m in diameter and is composed of an outer ring of granite stones varying in size from 20cm to over one meter in diameter. Feature 1 was excavated

to bedrock in three quadrants. The floor deposits extend to a maximum depth of c.500-600mm below the ground surface (Figure 5). Stratigraphic contexts in Feature 1 are divided into two broad phases related to the temporal occupation of the structure: early occupation and late occupation. Large quantities of dolerite debitage and other archaeological remains (i.e. potsherds and animal bone fragments) were allowed to accrue in the floor plan of the dwelling during this phase. Most of the lithic debris accumulated in the northwest quadrant towards the back of the structure. The degree of patination on most lithics suggests that artefacts lay exposed on the ground surface for extended periods during the late occupation phase – indicating periodic abandonment of the structure. The weathered state of some recovered bone fragments adds further support to this possibility. From this Feature 1, immense volume of dolerite debitage recovered from the upper portion of the stratified deposits suggests that Feature 1 functioned as a specialist axe production 'workshop' during the later phase of occupation. The inference that Feature 1 functioned as an axe manufacturing 'workshop' is lent additional support by the presence of several clusters of axe-grinding grooves on granite rocks situated in and around the structure. Survey of Area A has also led to the discovery of at least two nearby quarried outcrops of dolerite. These quarries were labelled the Upper Quarry (Area B) and the Lower Quarry (Area J).

They are both located at different elevations along the same linear trap dyke within several hundred metres of the Feature 1 axe-production 'workshop'.

Table: 6.2.1. Frequencies for artefact forms from Hiregudda

Site/Area	Trench /Feature	Detailed Analysis	Universal	Basic Count	Total
HGD-04, A	1	191(0.48)	16506(41.63)	22943(57.87)	39640
HGD-04, A	2	0 (0.00)	5424(85.40)	927(14.59)	6351
HGD-04, A	3	0 (0.00)	243 (35.16)	448 (64.83)	691
HGD-04, A	4	0 (0.00)	45 (100)	0 (0.00)	45
HGD-04, A	5	272 (13.41)	1903 (93.83)	147 (7.24)	2028
HGD-04, A	6	0 (0.00)	40 (0.12)	31002 (99.87)	31042
HGD-04, A	7	0 (0.00)	47 (13.20)	309 (86.79)	356
HGD-04, A	8	146 (0.49)	2811(9.54)	26488 (89.95)	29445
HGD-04, A	9	0 (0.00)	0 (0.00)	9718 (100)	9718
HGD-04, A	10	0 (0.00)	0 (0.00)	1396 (100)	1396
HGD-04, A	Feature-1	634 (0.10)	126271 (20.89)	477282 (78.99)	604187
HGD-04,B	1	297 (18.84)	1262 (80.07)	17 (1.07)	1576
HGD-04,B	2	0 (0.00)	732 (88.40)	96 (11.59)	828
HGD-04,B	3	0 (0.00)	13 (81.25)	3 (18.75)	16
HGD-04,B	4	0 (0.00)	3113 (100)	0 (0.00)	3113
HGD-04,D	1	0 (0.00)	0 (0.00)	2182 (100)	2182
HGD-04,D	2	0 (0.00)	0 (0.00)	14168 (100)	14168
HGD-04,D	2A	0 (0.00)	0 (0.00)	3728 (100)	3728
HGD-04,D	2B	0 (0.00)	0 (0.00)	2492 (100)	2492
HGD-04,D	3	0 (0.00)	0 (0.00)	5494 (100)	5494
HGD-04,D	3A	0 (0.00)	0 (0.00)	461 (100)	461
HGD-04,D	4	0 (0.00)	0 (0.00)	607 (100)	607
HGD-04,D	5	0 (0.00)	333 (13.80)	2079 (86.19)	2412
HGD-04,D	5A	33 (0.81)	1578 (39.11)	2423 (60.06)	4034
HGD-04,D	6	0 (0.00)	0 (0.00)	1614 (100)	1614
HGD-06,J	1	60 (0.84)	5001 (70.47)	2035 (28.67)	7096
HGD-06,J	2	77 (11.59)	587 (88.40)	0 (0.00)	664
Total		1710 (0.22)	165909 (21.39)	608185 (78.43)	775384

Recent quarrying and sediment extraction had created a large 'hollow' in the middle of the south-eastern part of the settlement site. As sections had already been exposed along three sides of this hollow, these were targeted and fully cleaned up (as Trenches 1, 2, 3, 4 and 7). Another trench (Trench 8) was located partly across the base of the hollow but also extended up into two terraced areas.

A total of 6, 04,187 lithic artefacts were retrieved from Trench 1-10 and Feature 1**(Table 6.2.1)**. Trench 1 and Feature 1 provided the largest counts of artefact as well as the best stratigraphic information; hence detailed analysis was conducted on these assemblages.

Table 6.2.2. Total amount of lithic assemblages from HGD-04, Area: A

Site/Area	Trench/Feature	Detailed Analysis	Universal	Basic Count	Total
HGD-04, A	1	191 (0.48)	16506 (41.63)	22943 (57.87)	39640
HGD-04, A	2	0 (0.00)	5424 (85.40)	927 (25.39)	6351
HGD-04, A	3	0 (0.00)	243 (35.16)	448 (64.83)	691
HGD-04, A	4	0 (0.00)	45 (100)	0 (0.00)	45
HGD-04, A	5	272 (13.41)	1903 (93.83)	147 (7.24)	2028
HGD-04, A	6	0 (0.00)	40 (0.12)	31002 (99.87)	31042
HGD-04, A	7	0 (0.00)	47 (13.20)	309 (86.79)	356
HGD-04, A	8	146 (0.49)	2811 (9.54)	26488 (89.95)	29445
HGD-04, A	9	0 (0.00)	0 (0.00)	9718 (100)	9718
HGD-04, A	10	0 (0.00)	0 (0.00)	1396 (100)	1396
HGD-04, A	Feature-1	634 (0.10)	126271 (20.9)	477282 (78.99)	604187

Table 6.2.3. Artefact types by raw material count from Trench 1 and Feature

Raw Material Types									
Artefact Types	**Dolerite**	**Quartz**	**Chert**	**Chalcedony**	**Granite**	**Quartz Crystal**	**Unidentified**	**Ochre**	**Total**
FS	4152(97.99)	38 (0.89)	35(0.82)	5 (0.11)	4(0.09)	2(0.04)	1(0.02)	0 (0.00)	4237
AS/BF and NFD	77923(99.84)	105(0.13)	3(0.003)	8(0.01)	0 (0.00)	3(0.003)	0 0.00)	0 (0.00)	78042
Early Reduction Flake	34128(99.92)	11(0.03)	4(0.01)	9(0.02)	2(0.005)	0 (0.00)	0 (0.00)	0 (0.00)	34154
Bifacial Thinning Flake	2483(100)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	2483
Axe Reworking Flake	235(100)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	235
Redirecting Flake	36(100)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	36
Retouched Artefact	260(95.94)	3(1.10)	8(2.95)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	271
Multiplatform Core	1(50.00)	1(50.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	2
Single Platform Core	2(100)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	2
Axe Blank	131(100)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	131
Axe	27(100)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	27
Edge Grinded Core	8(100)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	8
Other	24(88.88)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	3(11.11)	27
Assayed Core	11(91.66)	1(8.33)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	12

Contd.....

Indeterminate	93(7.70)	511(42.33)	0 (0.00)	0 (0.00)	568(47.05)	0(0.00)	35(2.89)	0 0.00)	1207
Hammerstone	85(98.83)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	1(1.16)	0 (0.00)	86
M	65(97.01)	0 (0.00)	0 (0.00)	0 (0.00)	1(1.49)	0 (0.00)	1(1.49)	0 (0.00)	67
G	3(25.00)	0 (0.00)	0 (0.00)	0 (0.00)	5(41.66)	0 (0.00)	4(33.33)	0 (0.00)	12
R	10(50.00)	3(15.00)	0 (0.00)	0 (0.00)	6(30.00)	0 0.00)	1(5.00)	0 0.00)	20
Blade	1 (3.70)	3 (11.11)	18 (66.66)	5 (18.51)	0 (0.00)	0 0.00)	0 0.00)	0 0.00)	27
Blade Core	0 (0.00)	0 (0.00)	8 (72.72)	3 (27.27)	0 (0.00)	0 0.00)	0 0.00)	0 0.00)	11
BA	107 (75.35)	16(11.26)	0 (0.00)	0 (0.00)	16(11.26)	0 0.00)	3(2.11)	0 0.00)	142
Micro Debitage	26688 (100)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	26688
CR	3(100)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 0.00)	0 0.00)	0(..00)	3
Non-Culture	2(100)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 0.00)	0 0.00)	0 0.00)	2
Core	23(51.11)	17 (37.77)	3(6.66)	1(2.22)	0 (0.00)	0 0.00)	1(2.22)	0(0.00)	45
Core Segment	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 0.00)	0 0.00)	0 0.00)	0
Bipolar Core	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 0.00)	0 0.00)	0 (0.00)	0
Flake	9(29.03)	21(67.74)		1 (3.22)	0 (0.00)	0 (0.00)	0 0.00)	0(0.00)	31
Total	146510(98.98)	730(0.49)	79(0.05)	32(0.02)	602(0.40)	5(0.003)	47(0.03)	3(0.002)	148008(100)

6.3. Trench 1 from Heregudda (HGD-A

Universal strategy

Trench 1 shows similar important patterns in the exploitation of raw materials through time. As is obvious from Table 6.3.1., the most preferred and exploited raw material was dolerite (99%). Other raw materials like quartz, chert, granite, chalcedony and crystal quartz makes up less than 1% of the total artefacts recovered. Yet, in Context 3055, the oldest or earliest level in the Area, quartz makes up the largest majority of the materials.

Table 6.3.1. Raw Material counts in percentage from Trench-1 of HGD, Area-A

Context	Dolerite	Quartz	Chert	Chalcedony	Granite	Crystal Quartz	Unknown	Total
3000	3662 (99.9)	0 (0.00)	0 0.00)	0 (0.00)	0 (0.00)	0 (0.00)	3(0.08)	3665(22.2)
3002	4216 (99.9)	0 (0.00)	0 0.00)	0 (0.00)	1(0.02)	0 (0.00)	1(0.02)	4218(25.6)
3012	6256 (99.6)	3(0.04)	5(0.07)	6(0.09)	7(0.11)	0 (0.00)	0 (0.00)	6277(38.1)
3015	916 (98.9)	0 (0.00)	0 0.00)	0 (0.00)	9 (0.97)	1 (0.10)	0 (0.00)	926 (5.6)
3016	510 (96.7)	17(3.2)	0 0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	527(3.2)
3017	400 (96.1)	6 (1.4)	4(0.96)	1 (0.24)	2 (0.48)	0 (0.00)	3 (0.72)	416(2.5)
3050	327(98.1)	0 (0.00)	0 0.00)	0 (0.00)	6 (1.8)	0 (0.00)	0 (0.00)	333 (2)
3055	29 (28.1)	60 58.2)	0 0.00)	0 (0.00)	14 13.5)	0 (0.00)	0 (0.00)	103 (0.62)
Total	16316 (99.0)	86 (0.52)	9(0.05)	7 (0.04)	39 0.23)	1 (0.01)	7 (0.04)	**16465**(100)

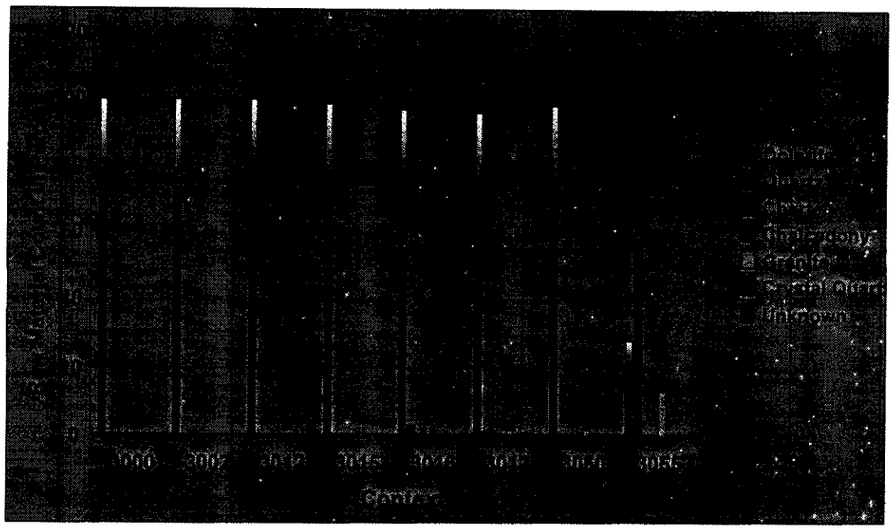

Figure 6.3.1. Raw Material count in percentage from HGD-04, Area-A, Trench-1

To understand the axe reduction sequence within Trench-1, key artefact types have been selected to indicate the nature of axe reduction (Table 6.3.2.). As indicated in the Table 6.3.2., axe blanks and axe reworking flakes are present, indicating that, axes were manufactured in and around this location. The early reduction flakes and the bifacial thinning flakes are present in relatively high percentages, though there is an important stratigraphic pattern in their frequency. In earlier contexts (3050, 3016 and 3015), bifacial thinning flakes (represents later stage of reduction in axe manufacture) are high in frequency, whereas in the younger levels (3012, 3002 and 3000), early reduction flakes (represents early stage of reduction in axe manufacture) have a higher percentage (see Figure 6.3.1). The pattern suggests that in the early levels, invasive flaking (late stage in axe production) of axe was more intensive, but in the later levels, initial shaping of early stage axes occurred.

Table 6.3.2. Artifact types within Trench-1 of HGD, Area-A

Context	Early Reduction Flakes	Bifacial Thinning Flakes	Axe Reworking Flakes	Axe Blanks	Total
3000	1455 (82.11)	295 (16.64)	20 (1.12)	2 (0.11)	1772 (100)
3002	1145 (62.36)	684 (37.25)	2 (0.10)	5 (0.27)	1836(100)
3012	3272 (52.29)	2944 (47.05)	15(0.23)	26(0.41)	6257(100)
3015	94 (30.51)	198 (64.28)	0 (0.00)	16(5.19)	308(100)
3016	161 (33.47)	314 (65.28)	1(0.20)	5(1.03)	481(100)
3050	65 (20.31)	252 (78.75)	3(0.93)	0 (0.00)	320(100)
Total	6300 (56.8)	4687(42.2)	48 (0.43)	55 (0.49)	11090(100)

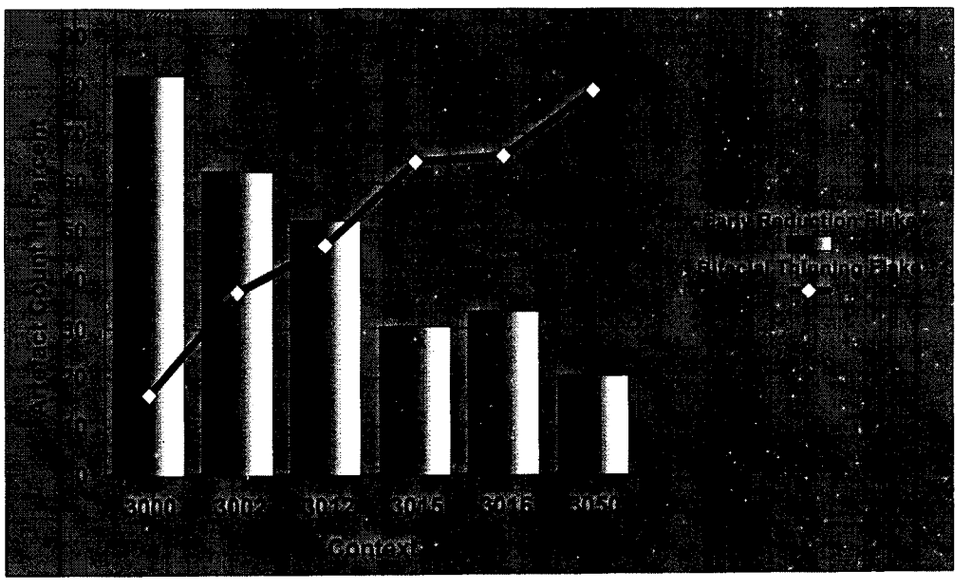

Figure 6.3.2. Comparison of early reduction flakes by bifacial thinning flakes in percentage from Trench-1, HGD-A.

Detailed analysis

Morphological variability within lithic assemblage. Artefacts were analyzed in a detailed way, in order to find the variability in size and shape of axe from this trench, and to find whether there is any change in the morphology of axes stratigraphically.

From Trench 1 a total of 225 artefacts were analyzed in a detailed way, out of these 225 artefacts, 180 (80%) were flakes, 17 (7.5%) were axes and 28 (12.4%) broken axes **(Table 6.3.3).**

Table 6.3.3. Frequency of flaked piece types from Trench 1 of HGD-A.

Flaked Piece Types	Frequency	Percent
Flake	180	80
Axes	17	7.5
Broken Axe	28	12.4
Total	225	100

General metrical measurements for axes types

Mean, standard deviation and coefficient of variation for general measurements like maximum dimension, maximum width, thickness and weight were recorded in order to explain the variability within axe size and shape from Trench 1.

Axe form 3061 were longer (108.22 mm), at the same time axes made in 3017 were wider (56.4 mm), when the thickness and weight in

considered, axes from 3050 context were thicker (35.51mm) and heavier (184.1 mm), whereas, axes made in context 3015 were shorter (69.68 mm) and narrower (37.18 mm), at the same time axe made from 3000 context were thinner (16.6 mm) and lighter (54.9 mm) (Table 6.3.4).

Table 6.3.4. Mean, standard deviation and coefficient of relation of general measurement for flake pieces.

Context	Variables	Mean	Std. Deviation	CV
3000	Length	80.31	10.62	0.13
	Maximum Width	40.67	1.83	0.04
	Thickness	16.6	4.16	0.25
	Weight	54.9	0.99	0.02
3002	Length	74.66	13.48	0.18
	Maximum Width	44.73	5.1	0.11
	Thickness	26.15	10.7	0.41
	Weight	107.6	48.98	0.46
3012	Length	82.86	12.81	0.15
	Maximum Width	49.18	16.6	0.34
	Thickness	28.72	4.32	0.15
	Weight	126.13	35.36	0.28
3015	Length	69.68	40.07	0.58
	Maximum Width	37.18	15.47	0.42
	Thickness	17.51	10.19	0.58
	Weight	84.32	109.11	1.29
3016	Length	108.22	34.27	0.32
	Maximum Width	47.38	13.97	0.29
	Thickness	19.32	2.39	0.12
	Weight	120	3.25	0.03
3017	Length	98.69	0.00	0.00
	Maximum Width	56.4	0.00	0.00
	Thickness	26.37	0.00	0.00
	Weight	155.1	0.00	0.00
3050	Length	98.93	0.00	0.00
	Maximum Width	55	0.00	0.00
	Thickness	35.51	0.00	0.00
	Weight	184.1	0.00	0.00

Influence of initial form on the variability observed in the axes

Initial form refers to the initial point from which the flaked piece was made. Initial form categories includes slab, blocky, flake, and indeterminate. Slab and blocky clasts were identified by the presence of cortex on the artefact. Flakes were identified by the presence of one or more attributes, including presence of platform, bulb of percussion, flake release surface, and ripples on the convex ventral surface.

Axes made on indeterminate were longer (102.43 mm), wider (53.27 mm), whereas, axes made from blocky clast type are thicker (37.92 mm) and heavier (144.40 mm), at the same time when the axes made from slabs were shorter (70.87 mm) and narrower (44.69 mm), whereas, axes made from flakes are thinner (18.52 mm) and lighter (86.35 mm). Irrespective of the initial form from which the axes were made, axe from the Post-Ashmound Village phase (i.e, from 3015 context), there is a sudden change in the length, width, thickness and weight of axes, where axes from the Post-Ashmound Village phase become longer, wider, thicker and heavier than the context from the Post-Ashmound Pitting phase (i.e, starting from 3000 to 3015 context number) (Figure 6.3.3 to 6.3.6).

Table 6.3.5. Mean, standard deviation coefficient of variation of general measurement for axes broken down initial form.

Initial Form	Variable	Mean	Std. Deviation	CV
Slab	Length	70.87	0.00	0.00
	Maximum Width	44.69	0.00	0.00
	Thickness	27.46	0.00	0.00
	Weight	119.90	0.00	0.00
Blocky	Length	78.74	0.00	0.00
	Maximum Width	47.04	0.00	0.00
	Thickness	37.92	0.00	0.00
	Weight	144.40	0.00	0.00
Indeterminate	Length	102.43	18.78	0.18
	Maximum Width	53.27	4.39	0.08
	Thickness	31.11	6.60	0.21
	Weight	195.17	74.92	0.38
Flakes	Length	84.52	21.73	0.26
	Maximum Width	45.36	11.24	0.25
	Thickness	18.52	4.84	0.26
	Weight	86.35	48.90	0.57

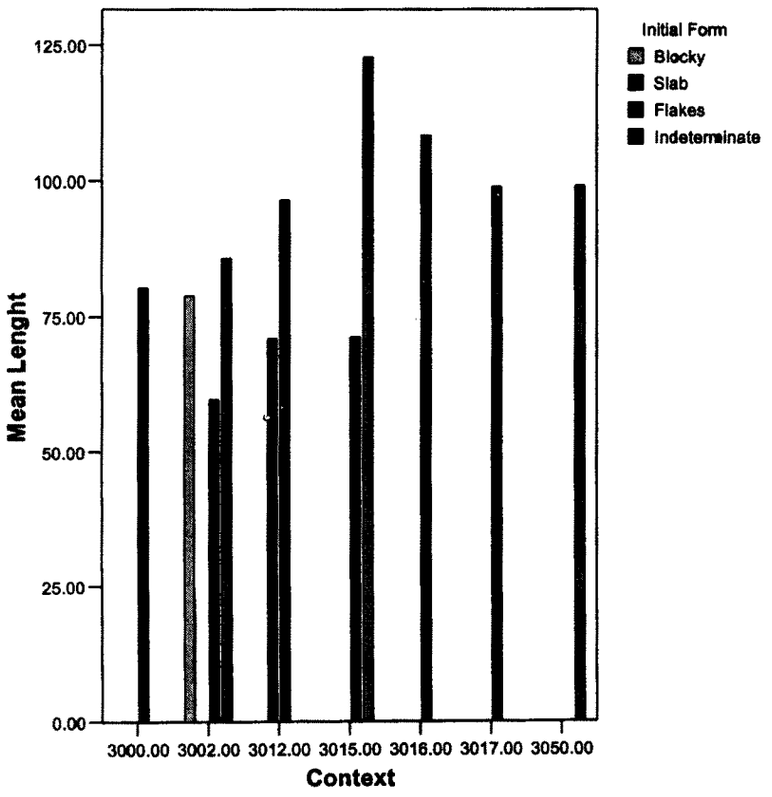

Figure 6.3.3. Mean length of axe broken down by initial form.

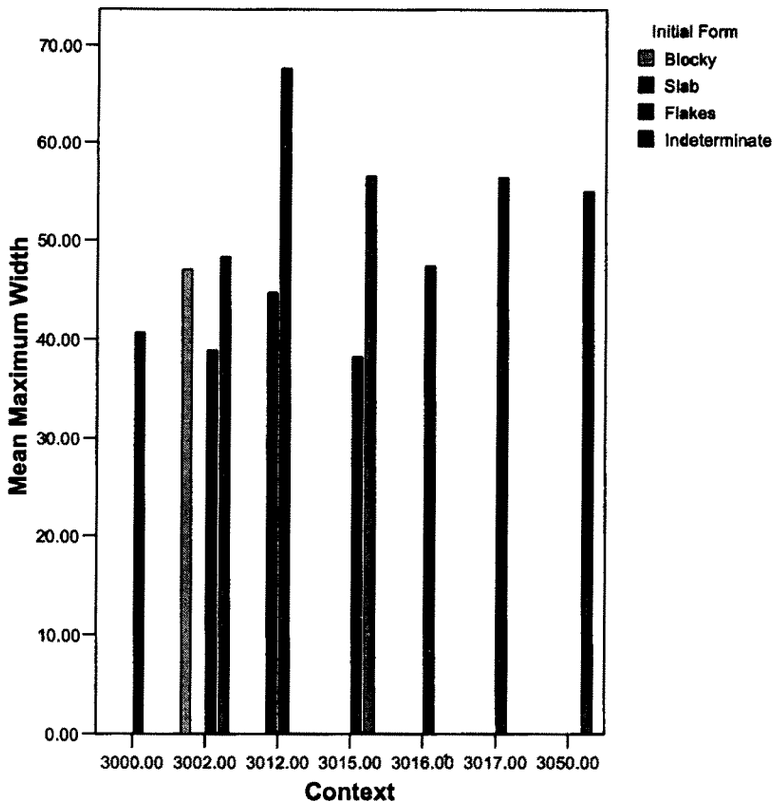

Figure 6.3.4. Mean maximum width of axe broken down by initial form.

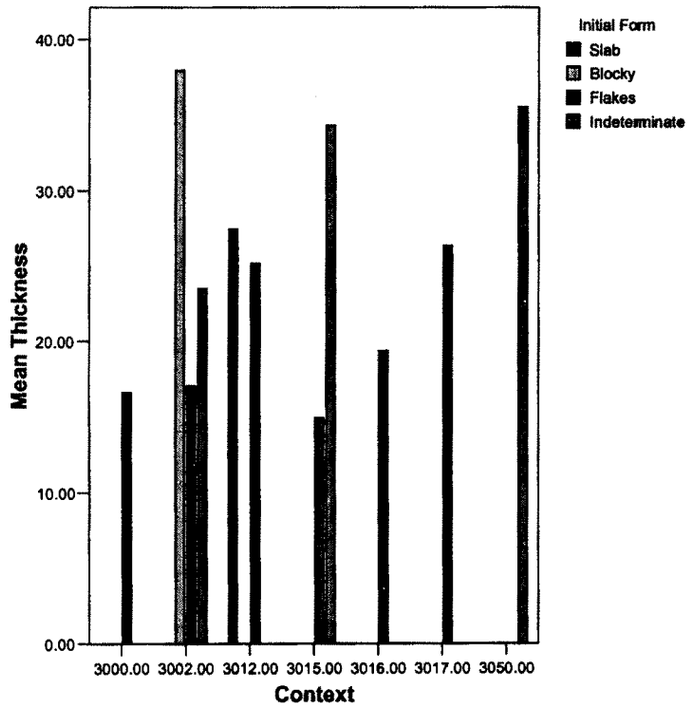

Figure 6.3.5. Mean thickness of axe broken down by initial form.

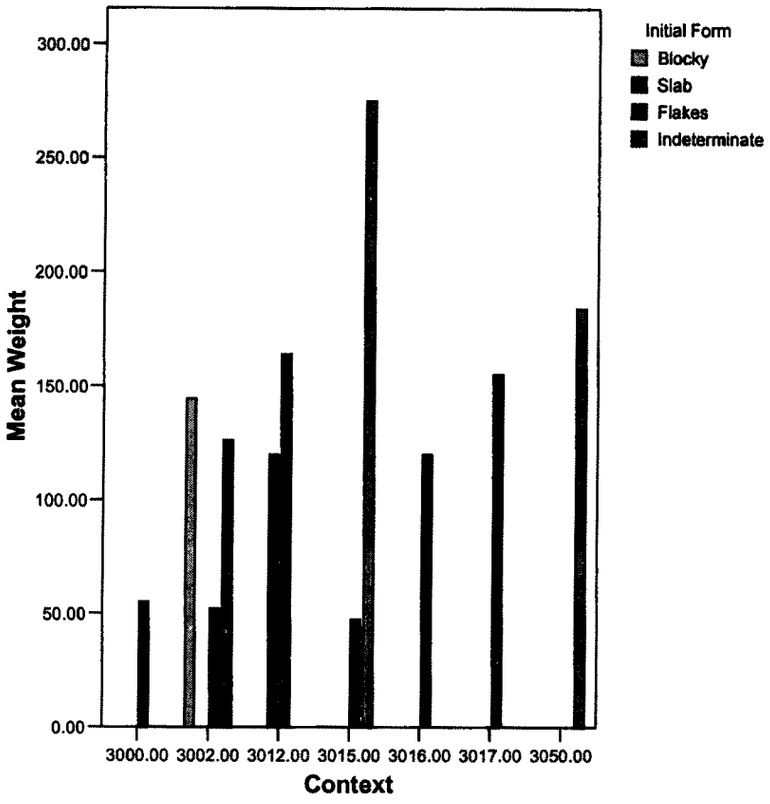

Figure 6.3.6. Mean weight of axe broken down by initial form.

6.4. Feature 1 from Heregudda (HGD A)

Universal strategy

Feature 1 contained an enormous number of lithic artefacts (n=604,187), representing the highest density of lithic artefacts recovered from any site excavation. As indicated in Table 6.4.1., the most common raw material was dolerite, comprising 98.8% of recovered artefacts. Other raw material comprise of less than 2% of the assemblage. It is interesting to note that, from the habitation levels (especially Context 3061), granite is present in higher numbers, suggesting that granite was struck for building materials or to

manufacture and maintain querns, an activity that was also noticed in the habitation layers of Sanrachamma. Another notable trend is the recovery of higher proportion of quartz artefacts in the gruss layer than the later levels, which is similar to what is observed in Trench 1 and in Sanrachamma and Choudammagudda.

Table 6.4.1. Raw Material count from Feature-1 of HGD, Area-A

Dolerite	Quartz	Chert	Chalcedony	Granite	Crystal Quartz	Unknown	Total
Surface and Upper layers (3020, 3026, 3027, 3034, 3035, 3036, 3032 and 3038)							
64934(99.7)	77(0.11)	42(0.06)	10(0.01)	23(0.03)	3(0.004)	35(0.05)	65124(51.5)
Thick habitation layers (3065, 3058, 3059, 3061 and 3060)							
31164(98.9)	32(0.10)	9(0.02)	2(0.006)	293(0.93)	0 (0.00)	1(0.003)	31501(24.9)
Thinner habitation layers (3148, 3196, 3151, 3183, 3153, 3029 and 3167)							
24295(97.4)	446(1.7)	7(0.02)	2(0.008)	168(0.67)	1(0.004)	2(0.008)	24921(19.7)
Gruss layer (3255, 3030 and 3174)							
4466(94.5)	199(4.2)	11(0.23)	11(0.23)	36(0.76)	0 (0.00)	2(0.04)	4725(3.7)
Total							
124859 (98.8)	754(0.59)	69(0.05)	25(0.01)	520(0.41)	4(0.003)	40(0.03)	126271(100)

To understand the axe reduction sequence within Feature 1, key artefact types have been selected to indicate the nature of axe reduction (Table 6.4.2). Among the selected artefact types from this feature, early reduction flakes have the highest percentage (89.9%) than other artefact types like bifacial thinning flake and axe reworking flakes (less than11%). As indicated in the (Table 6.4.2)., early reduction flakes and the bifacial thinning flakes decreases as the depth increases (Figure 6.4.1). These points to the facts that, a great amount of skill was invested on making early stage axes compared to late stage of axe production.

Table 6.4.2 Artifact types in percentage within Feature-1 of HGD, Area-A

Early Reduction Flake	**Bifacial Thinning Flake**	**Axe Reworking Flake**	**Axe Blank**	**Axe**	**Total**
Surface and Upper layers (3020, 3026, 3027, 3034, 3035, 3036, 3032 and 3038)					
10724 (83.9)	1949 (15.2)	73 (0.57)	28 (0.21)	7 (0.05)	12781(40.79)
Thick habitation layers (3065, 3058, 3059, 3061 and 3060)					
7561 (91.5)	585 (7)	69 (0.83)	38 (0.45)	9 (0.10)	8262 (26.37)
Thinner habitation layers (3148, 3196, 3151, 3183, 3153, 3029 and 3167)					
8635 (96.6)	241 (2.6)	39 (0.43)	10 (0.11)	7 (0.07)	8932 (28.51)
Gruss layer (3255, 3030 and 3174)					
1257 (92.8)	87 (6.4)	6 (0.44)	0 (0.00)	4 (0.29)	1354 (4.32)
Total					
28177 (89.9)	2862(9.1)	187(0.59)	76(0.24)	27(0.08)	31329(100)

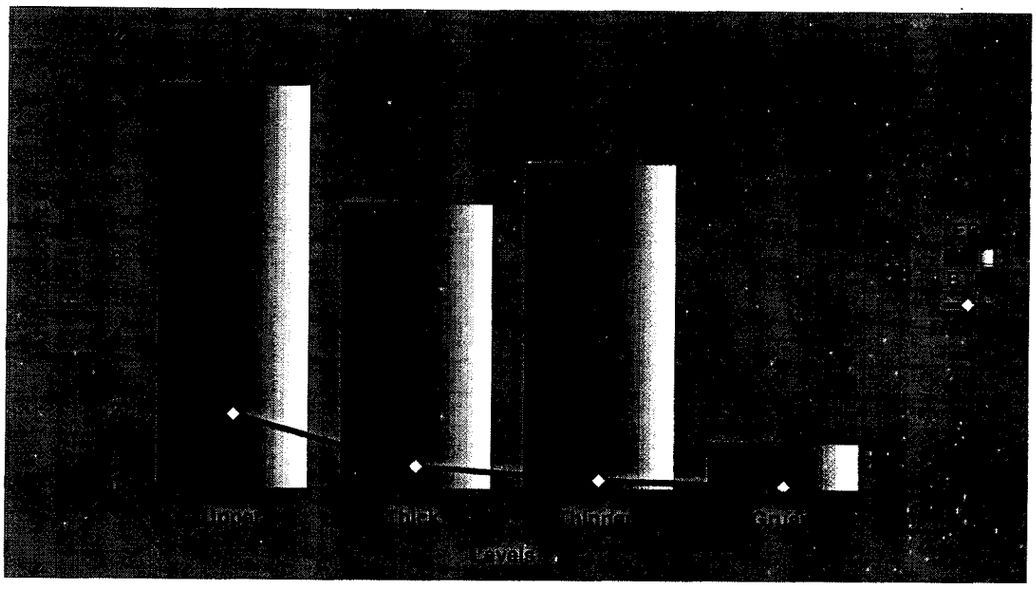

Figure 6.4.1. Comparison of early reduction flakes by bifacial thinning flakes within the layers from Feature 1, HGD-A.

Detailed analysis

Morphological variability within lithic assemblage. From Trench 1 a total of 734 artefacts were analyzed in a detailed way, out of these 734 artefacts, 556 (75.75 %) were flakes, 85 (11.58 %) were axes and 93 (12.67 %) were broken axes (Table 6.4.3).

Table 6.4.3. Frequency of flaked piece types from Feature 1 of HGD-A.

Flaked Piece Type	Frequency	Percent
Flake	556	75.75
Axes	85	11.58
Broken Axe	93	12.67
Total	734	100

General metrical measurements for axes types

General measurements like maximum dimension, maximum width, thickness and weight were recorded in order to explain the size and shape of axe types from Feather 1. Mean, standard deviation and coefficient of variation values were obtained in order to explain the variability within axe size and shape.

Axe from context 3256, were longer (63.11mm), wider (46.59 mm), thicker (13.65 mm) and heavier (56.4 mm), whereas, axes from 3196 context were shorter (17.67 mm), narrower (14.84 mm), thinner (4.17 mm) and lighter (0.9 mm) (Table 6.4.4).

Table 6.4.4. Mean, standard deviation coefficient of variation of general measurement for axes from Feature 1.

Context	Variables	Mean	Std. Deviation	CV
3026	Length	45.59	32.97	0.72
	Maximum Width	32.44	15.41	0.48
	Thickness	7.3	3.72	0.51
	Weight	9.06	12.44	1.37
3153	Length	50.79	20.23	0.40
	Maximum Width	35.79	11.72	0.33
	Thickness	6.08	3.29	0.54
	Weight	8.4	8.77	1.04
3196	Length	17.67	0.00	0.00
	Maximum Width	14.84	0.00	0.00
	Thickness	4.17	0.00	0.00
	Weight	0.9	0.00	0.00
3256	Length	63.11	48.92	0.78
	Maximum Width	46.59	46.87	1.01
	Thickness	13.65	9.2	0.67
	Weight	56.4	76.79	1.36

Influence of cortex type on the variability observed in the axes

From this site majority of axes were made from angular clast types. Axes made on angular were longer (84.45), wider (48.26), thicker (20.83) and heavier (12.07), whereas, axes made from sub-angular clast type were shorter (73.29), narrower (32.35), thinner (13.82) and lighter (38.20) (Table 6.4.5). Figure 6.4.2 to 6.4.5., indicate that axes from the Post-Ashmound Pitting phase (i.e., 3026, 3032, 3034, 3035 and 3036 contexts) are shorter, narrower and lighter that the axes Post-Ashmound Village phase (i.e., 3060, 3061, 3148, 3151, 3153 and 3256 contexts) which were longer, wider and heavier, but when the thickness is taken into account there is not much difference because it might be due to the fact that the clast types were exploited from the same place.

Table 6.4.5. Mean, standard deviation coefficient of variation for general measurement of axes broken down by cortex type from Feature 1.

Cortex Type	Variable	Mean	Std. Deviation	CV
Angular	Length	84.45	25.43	0.30
	Maximum Width	48.26	13.88	0.29
	Thickness	20.83	9.41	0.45
	Weight	120.07	123.69	1.03
Sub-Angular	Length	73.29	18.71	0.26
	Maximum Width	32.35	3.58	0.11
	Thickness	13.82	1.74	0.13
	Weight	38.20	10.76	0.28
Sub-Rounded	Length	78.49	15.68	0.20
	Maximum Width	45.45	5.44	0.12
	Thickness	18.14	5.56	0.31
	Weight	87.10	64.50	0.74

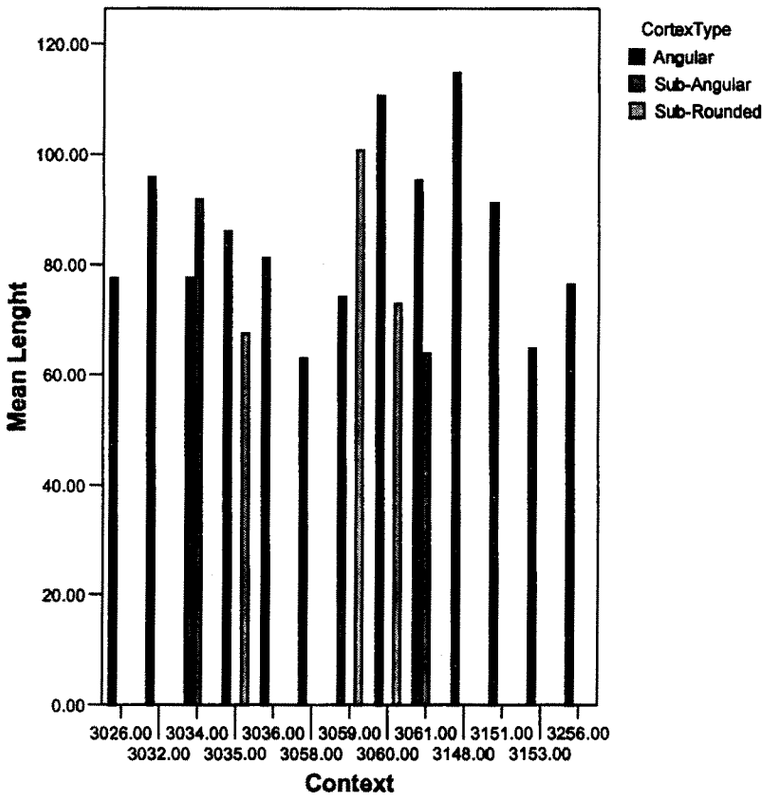

Figure 6.4.2. Mean length of axe broken down by cortex type.

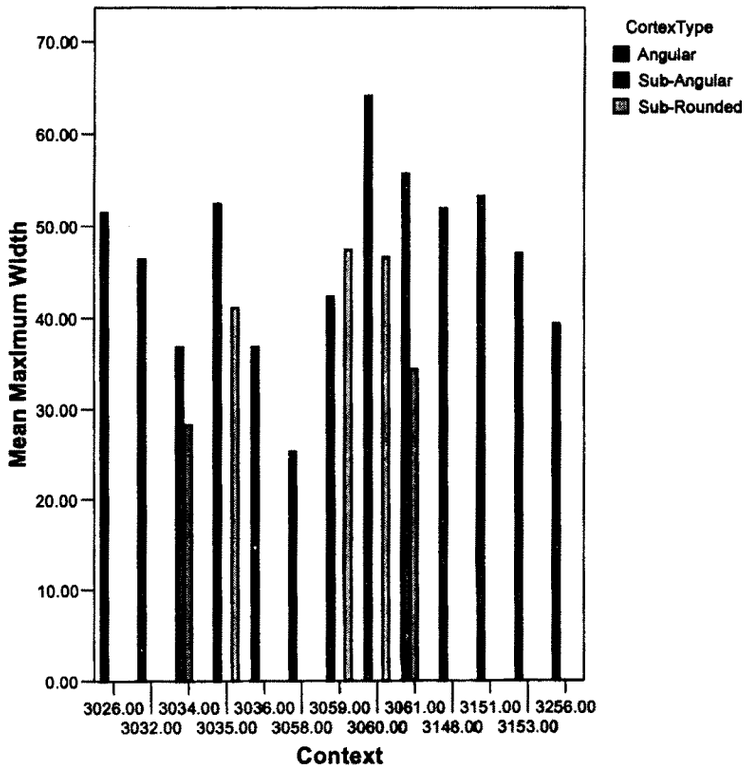

Figure 6.4.3. Mean maximum width of axe broken down by cortex type.

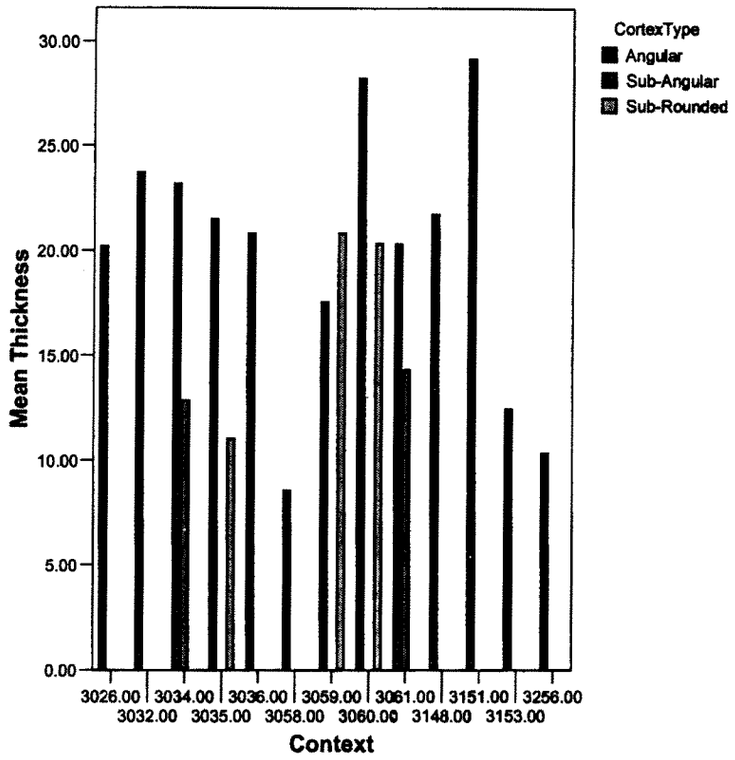

Figure 6.4.4. Mean thickness of axe broken down by cortex type.

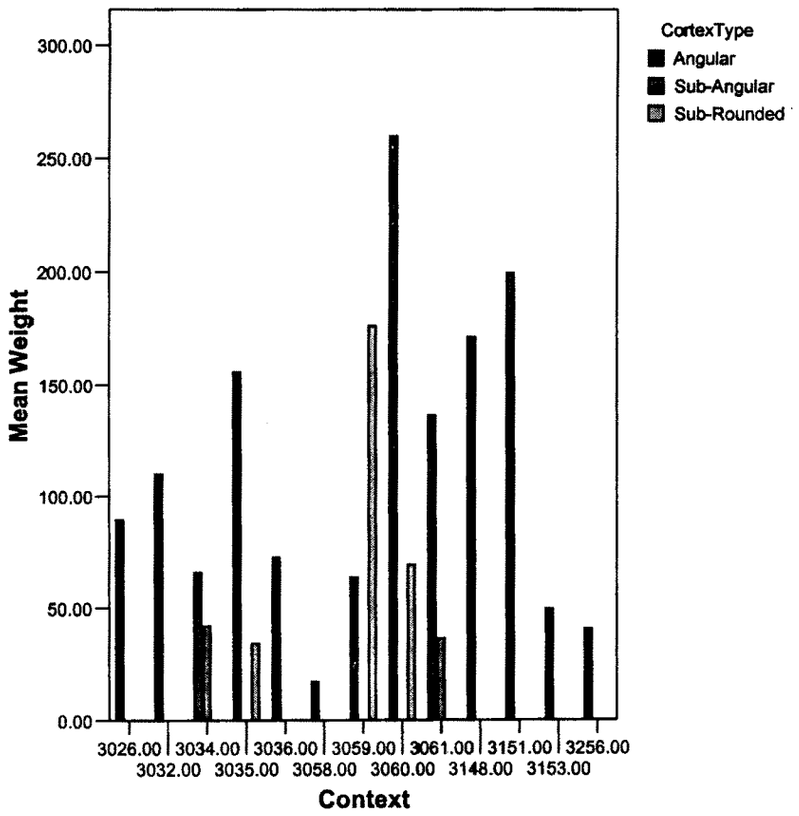

Figure 6.4.5. Mean weight of axe broken down by cortex type.

Influence of initial form on the variability observed in the axes

Table 6.4.6., reveals the effects of initial form on the size and shape of axes types. Majority of axes from Feature 1 were made from flakes. When axe made from initial form were compared, axe made from blocky clast were longer (107.26 mm), wider (61.09 mm), thicker (38.84 mm), but axe made from indeterminate were heavier (159.43 mm), whereas, axes made from flakes were shorter (74.53 mm), narrower (42.81 mm), thinner (18.26 mm) and lighter (78.26 mm). **Figure 6.4.6 to ---** indicates that axes made out of slab and indeterminate are shorter, narrower, thinner and lighter from Post-Ashmound Pitting phase and these axes made from same initial form become longer, wider, thicker and heavier from the Post-Ashmound Village phase, whereas, axes made from flakes become shorter, narrower, thinner and lighter in the Post-Ashmound Village phase than Post-Ashmound Pitting phase, where the axes are longer, wider, thicker and heavier.

Table 6.4.6. Mean, standard deviation coefficient of variation for general measurement of axes broken down by initial from Feature 1.

Initial Form	Variable	Mean	Std. Deviation	CV
Flakes	Length	74.53	15.84	0.21
	Maximum Width	42.81	11.48	0.27
	Thickness	18.26	7.26	0.40
	Weight	78.26	71.20	0.91
Indeterminate	Length	94.39	26.55	0.28
	Maximum Width	48.07	14.26	0.30
	Thickness	26.66	7.17	0.27
	Weight	159.43	136.46	0.86
Slab	Length	88.48	19.92	0.23
	Maximum Width	43.68	9.03	0.21
	Thickness	23.98	5.80	0.24
	Weight	125.17	60.11	0.48
Blocky	Length	107.26	1.31	0.01
	Maximum Width	61.09	19.01	0.31
	Thickness	38.84	3.80	0.10
	Weight	276.10	158.25	0.57

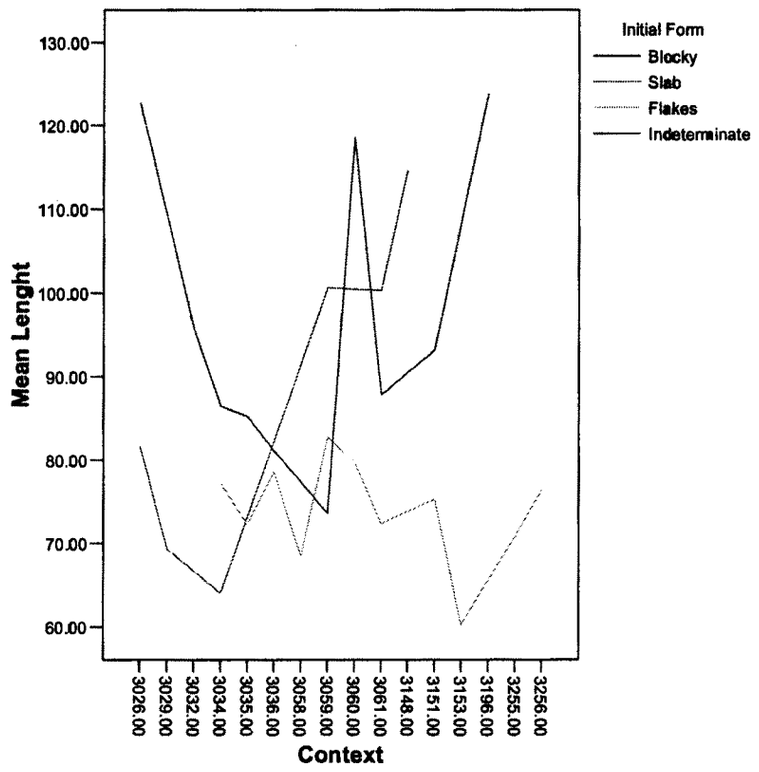

Figure 6.4.6. Mean length of axe broken down by initial form.

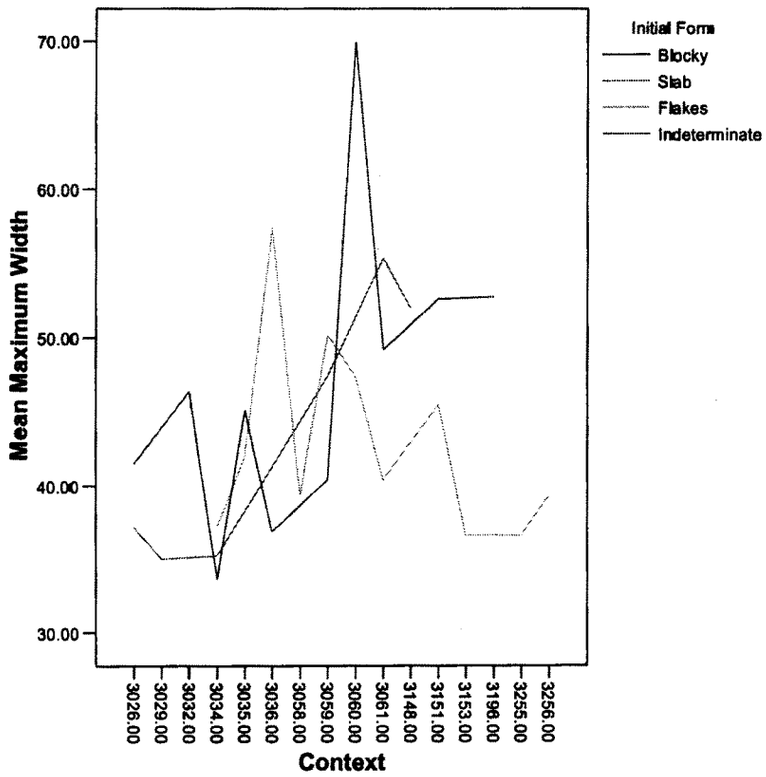

Figure 6.4.7. Mean maximum width of axe broken down by initial form.

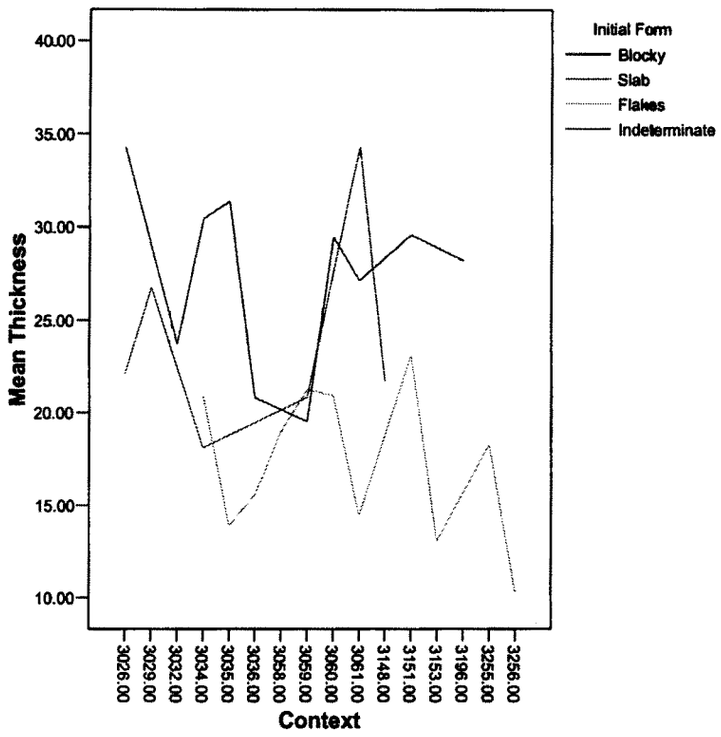

Figure 6.4.8. Mean thickness of axe broken down by initial form.

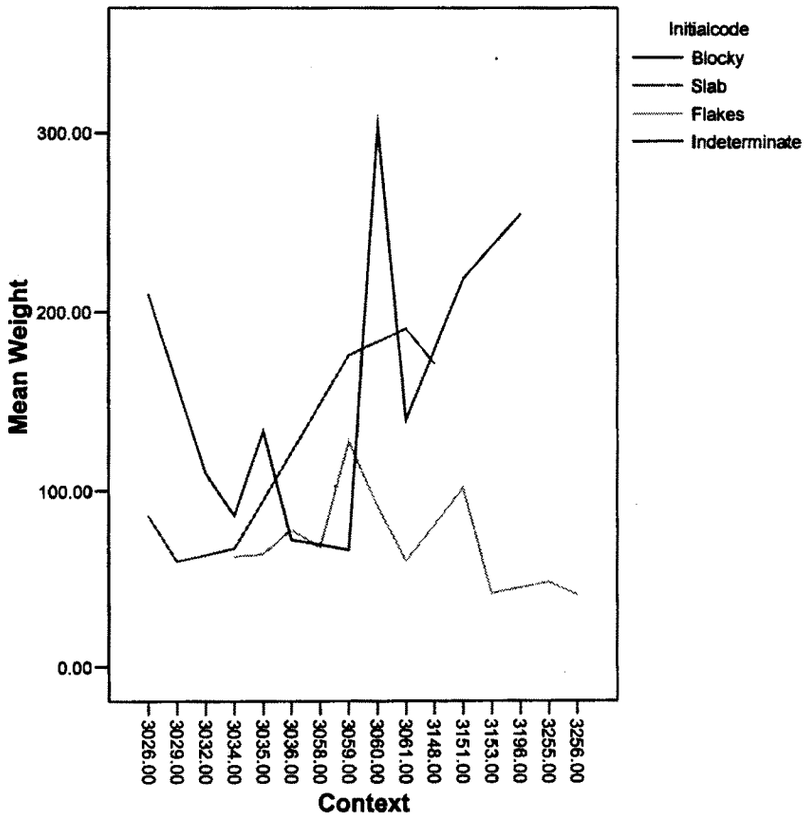

Figure 6.4.9. Mean weight of axe broken down by initial form.

6.5. Lithic from Sannarachamma Gudda

Universal strategy

A total of 25,969 lithic artefacts were collected from Trench 10, 11 and 12. Trench 10 provided the most important stratigraphic information; hence analysis has been performed on the 10,252 recovered from this excavation (Table 6.5.1)

Table 6.5.1. Total number of artefacts analyzed in different methods from Sannarachamma Gudda.

Site/Area	Trench/Feature	Detailed Analysis	Universal	Basic Count
SAN-04	10	329 (2.70)	11318 (93.02)	12167 (46.85)
SAN-04	11	0	1154	6693 (25.77)
SAN-04	12	0	0	7109 (27.37)
Total		329	12472	25969 (100)

When a comparison was made between artefact types and raw material wise, it revealed that, in the pre-ashmound level (1211, 1226 and 1100) quartz was the over whelming dominant raw material (Figure 6.5.1). As indicated in Table 6.5.2., most of the blades (66) and retouched artifacts (38) were made from quartz and these blades were removed by using multi-directional method. Initial analysis of the artefact show that flake cores were more in number than the blade cores and it is also interesting to note that the maximum number of blade cores was made from pebbles by using bipolar technique. Blades were

removed in order to make the backed artefacts. Most of the flake cores from comparatively larger pebbles and from block or angular clasts and they had multiple platforms. It is noticeable that blades are also made from chart, suggesting use and curation of these tool types, even though no blade cores have been recovered.

In the initial levels of the ashmound, though there is a small quantity (38) of dolerite flakes, quartz (720) remains the predominant raw-material (Table 6.5.2). In the initial levels of the ashmound (1183), the technology employed in flaking quartz appeared to be the same as pre-ashmound levels. The same pattern is noticed even in Phase 3 (1191). The presence of a low number of dolerite flakes is noticeable, which is the beginning of the use of raw material.

In 1168, the main ashmound layers (1166 and 1168), a range of raw materials are exploited, in contrast to pre-ashmound contexts (Figure 6.5.1). In this phase, granite artifacts were recovered, suggesting the shaping of granite artifacts, perhaps as building material and quern, manufacture and maintenance. Though quartz artifacts continued to be produced the relative use of quartz decreases substantially in comparison to pre-ashmound layers. An important feature is the presence of dolerite artifacts, indicative of the first sings of axe manufacture. Though chert never used in high frequency, the

appearance of this material in the ashmound phase indicates the introduction of siliceous stone, possibly indicative of import of exotic raw materials.

In 1157, the habitation strata, dolerite makes up the majority of exploited raw-material, likely signaling the importance of axe production (Figure 6.5.2). Like the ashmound layers, a diversity of raw materials is used. It is interesting to note that chert and chalcedony are better represented in the habitation phase in comparison to previous periods. Indeed, although chert is a rare raw-material in this area, a total of 45 blade and retouched artifacts were produced from chert (Table 65.2.).

From the post-ashmound strata, the intensity of dolerite flaking activity increases significantly (Figure 6.5.3) onwards till the post-abandonment deposits and in the later pit phase, the quantity of dolerite in the raw-material count and also the intensity of dolerite flaking activity increases significantly (Figure6.5.3). Most of the flakes are early reduction flakes, few bifacial thinning flakes and axe reworking flakes, which suggest that axes were shaped, and some of them would have been reworked (Table 6.5.2). Though quartz and granite are resent, their relative use in proportion to dolerite declines substantially. The

exploitation of high proportions of dolerite in this phase corresponds well with the assemblages from Heregudda, Area A.

Table 6.5.2. Artefact types by raw material from SAN, Trench 10.

Artefact Types	**Pre Ashmound** (1100, 1226 and 1211)								Total
	Raw Materials								
	Dolerite	**Quartz**	**Chert**	**Chalcedony**	**Granite**	**Q.C**	**Un**	**Ochre**	
FS	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	1(100)	0 (0.00)	1
AS/BF and NFD	1 (0.01)	6307 (98.96)	54 (0.84)	0 (0.00)	0 (0.00)	0 (0.00)	11(0.17)	0 (0.00)	6373
ER	1 (0.29)	325 (95.0)	13 (3.80)	0 (0.00)	0 (0.00)	0 (0.00)	3 (0.87)	0 (0.00)	342
RDF	0 (0.00)	1 (50.00)	1 (50.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	2
RA	0 (0.00)	38 (90.47)	3 (7.14)	0 (0.00)	0 (0.00)	1 (2.38)	0 (0.00)	0 (0.00)	42
MC	0 (0.00)	35 (100)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	35
SC	0 (0.00)	2 (100)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	2
HS	0 (0.00)	1 (100)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	1
B	0 (0.00)	66 (74.15)	19 (21.3)	1 (1.12)	0 (0.00)	0 (0.00)	3 (3.37)	0 (0.00)	89
BC	0 (0.00)	5 (100)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	5
MD	0 (0.00)	12 (100)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	12
Core	0 (0.00)	14 (100)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	14
CS	0 (0.00)	40 (100)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	40
BiC	0 (0.00)	4 (100)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	4
F	0 (0.00)	517 (95.3)	22 (45.0)	1 (0.18)	0 (0.00)	0 (0.00)	2 (0.36)	0 (0.00)	542
Total	**2 (0.02)**	**7367(98.17)**	**112 (1.49)**	**2 (0.02)**	**0 (0.00)**	**1 (0.01)**	**20 (0.26)**	**0 (0.00)**	**7504**
Artefact Type	**Initial Ashmound** (1157, 1166 and 1168)								**Total**
	Raw Materials								
	Dolerite	**Quartz**	**Chert**	**Chalcedony**	**Granite**	**Q.C**	**Un**	**Ochre**	
FS	2 (1.13)	168 (95.45)	2 (1.13)		0 (0.00)	4 (2.27)	0 (0.00)	0 (0.00)	176
AS/BF and NFD	19 (4.0)	453 (95.56)	1 (0.21)	0 (0.00)	1 (0.21)	0 (0.00)	0 (0.00)	0 (0.00)	474
ER	11 (19.6)	43 (76.78)	2 (3.57)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	56
ARF	2 (100)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	2
RA	0 (0.00)	3 (60.00)	2 (40.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	5

Contd.....

Axe	1 (100)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	1
Un	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	3 (7.14)	0 (0.00)	39 (92.8)	0 (0.00)	42
HS	1 (50.00)	1 (50.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	2
G	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	1 (25.00)	0 (0.00)	3 (75.00)	0 (0.00)	4
B	0 (0.00)	2 (25.00)	6 (75.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	8
MD	0 (0.00)	28 (100)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	28
NC	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)
Core	2 (8.00)	22 (88.00)	0 (0.00)	0 (0.00)	1 (4.00)	0 (0.00)	0 (0.00)	0 (0.00)	25
F	0 (0.00)	0 (0.00)	1 (2.32)	0 (0.00)	42 (97.67)	0 (0.00)	0 (0.00)	0 (0.00)	43
Total	**38 (4.38)**	**720 (83.14)**	**14 (1.61)**	**0 (0.00)**	**48 (5.54)**	**4 (0.46)**	**42 (4.84)**	**0 (0.00)**	**866**
Artefact Type	**Habitation and Ashmound** (1157, 1166 and 1168)								**Total**
	Raw Materials								
	Dolerite	Quartz	Chert	Chalcedony	Granite	Q.C	Un	Ochre	
FS	3 (4.10)	61(83.56)	2(2.73)	0 (0.00)	1(1.36)	4(5.47)	2(2.73)	0 (0.00)	73
AS/BF and NFD	84 (45.90)	89(48.63)	9(4.91)	0 (0.00)	1(0.54)	0 (0.00)	0 (0.00)	0 (0.00)	183
ER	38 (46.91)	12(14.81)	22(27.16)	1(1.23)	8(9.87)	0 (0.00)	0 (0.00)	0 (0.00)	81
ARF	1 (100)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	1
RDF	0 (0.00)	0 (0.00)	1(100)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	1
RA	1 (10.00)	0 (0.00)	9(90.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	10
Axe	1 (50.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	1(50.00)	0 (0.00)	2
Other	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	1(100)	0 (0.00)	1
Un	37(9.61)	2(0.51)	0 (0.00)	0 (0.00)	208(54.02)	0 (0.00)	138(35.84)	0 (0.00)	385
HS	11(55.00)	1(5.00)	0 (0.00)	0 (0.00)	2(10.00)	0 (0.00)	6(30.00)	0 (0.00)	20
M	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0
G	31(23.48)	5(3.78)	0 (0.00)	0 (0.00)	54(40.90)	0 (0.00)	42(31.81)	0 (0.00)	132
B	0 (0.00)	0 (0.00)	36(100)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	36
Core	5(16.12)	21(67.74)	4(11.11)	0 (0.00)	0 (0.00)	0 (0.00)	1(3.22)	0 (0.00)	31
F	0 (0.00)	7(87.5)	1(12.5)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	8
Total	**212(21.87)**	**198(20.43)**	**84(8.66)**	**1(0.10)**	**274(28.27)**	**4(0.41)**	**191(19.71)**	**0 (0.00)**	**964**

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Artefact Types	**Post Ashmound** (1142, 1227, 1147, 1118, 1146 and 1131)								**Total**
	Raw Materials								
	Dolerite	Quartz	Chert	Chalcedony	Granite	Q.C	Un	Ochre	
FS	10 (45.45)	9 (40.90)	1(4.54)	0 (0.00)	2 (9.09)	0 (0.00)	0 (0.00)	0 (0.00)	22
AS/BF and NFD	279 (86.64)	42 (13.04)	1 (0.31)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	322
ER	238 (97.94)	4 (1.64)	0 (0.00)	0 (0.00)	1(0.41)	0 (0.00)	0 (0.00)	0 (0.00)	243
BTF	43 (100)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	43
ARF	6 (100)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	6
RDF	2 (100)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	2
RA	3 (60.00)	0 (0.00)	1 (20.00)	0 (0.00)	1 (20.00)	0 (0.00)	0 (0.00)	0 (0.00)	5
AB	7 (100)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	7
Un	4 (2.79)	22 (15.38)	0 (0.00)	0 (0.00)	91(63.63)	0 (0.00)	26 (18.18)	0 (0.00)	143
HS	26 (96.29)	1 (3.70)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	27
G	8 (36.36)	0 (0.00)	0 (0.00)	0 (0.00)	12 (54.54)	0 (0.00)	2 (9.09)	0 (0.00)	22
B	5 (25.00)	0 (0.00)	11(55.00)	4 (20.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	20
BC	1 (100)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	1
Core	6 (60.00)	3 (30.00)	0 (0.00)	1 (10.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	10
BiC	0 (0.00)	1 (100)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	1
F	0 (0.00)	22 (84.61)	0 (0.00)	1 (3.84)	2 (7.69)	0 (0.00)	0 (0.00)	1 (3.84)	26
Total	**638**	**104**	**14**	**6**	**109**		**28**	**1**	**900**
Grand Total	**890**	**8389**	**224**	**9**	**431**	**9**	**281**	**1**	**10,252**

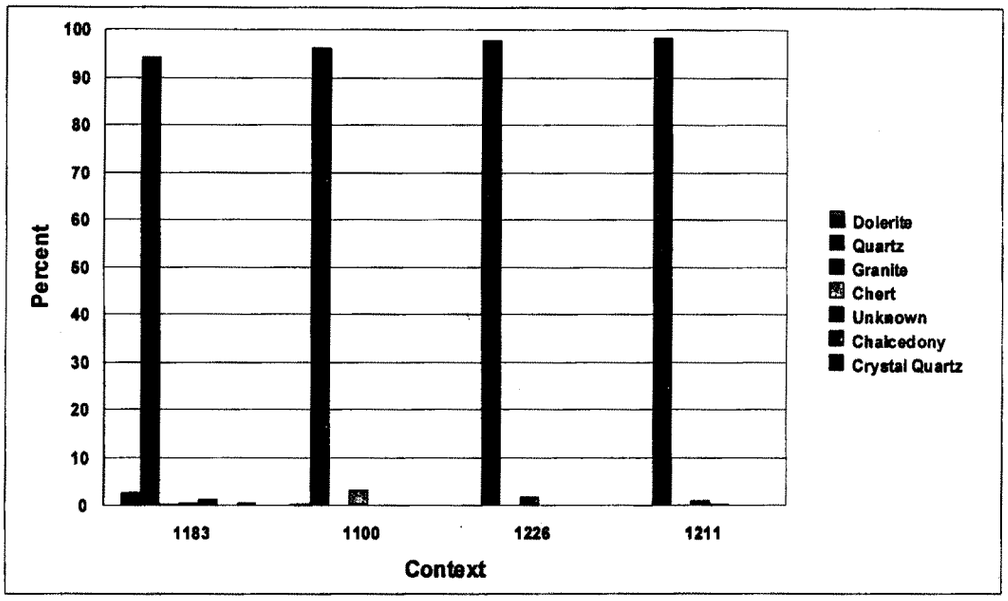

Figure 6.5.1. Raw Material in percentage from Initial (1183) and Pre-Ashmound 1100, 1226 and 1211) Phase, San-04, Trench-10

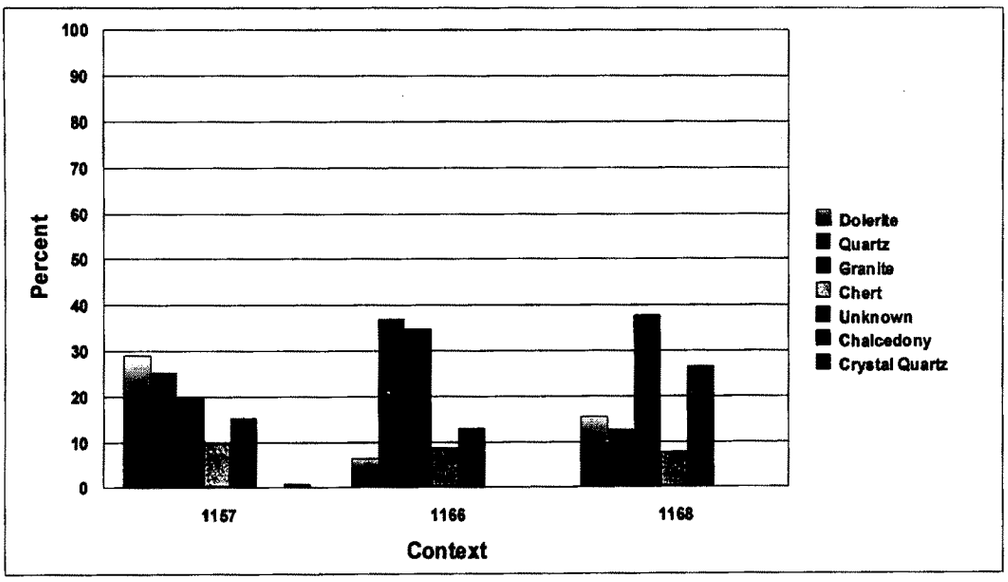

Figure 6.5.2. Raw Material in percentage from Main Ashmound Phase (1166 and 1168) and Habitation (1157), San-04, Trench-10

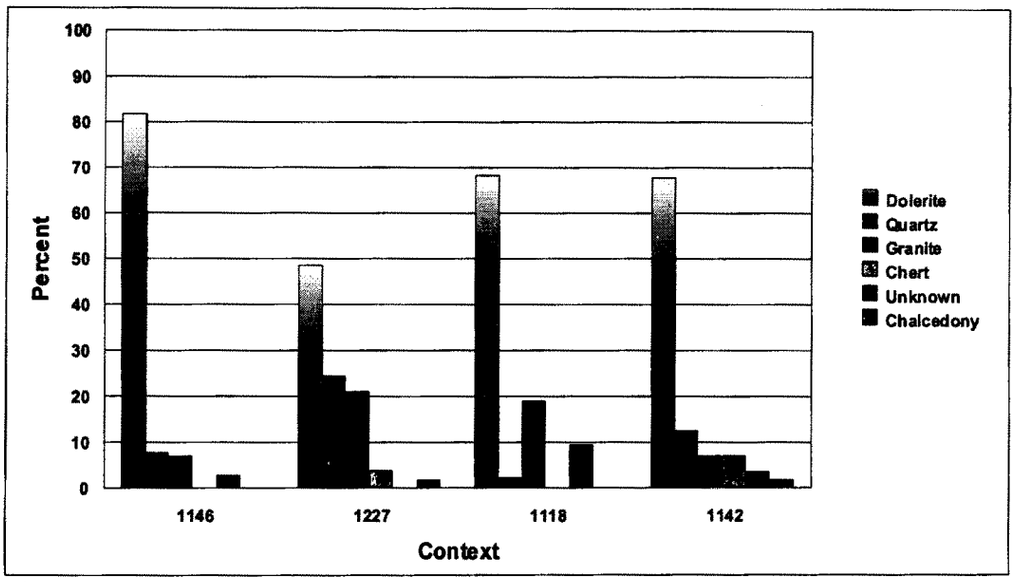

Figure 6.5.3. Raw Material in percentage from Post-Ashmound Phase (1142, 1227, 1147, 1118, 1146 and 1131) and Upper levels of ashmound, San-04, Trench-10

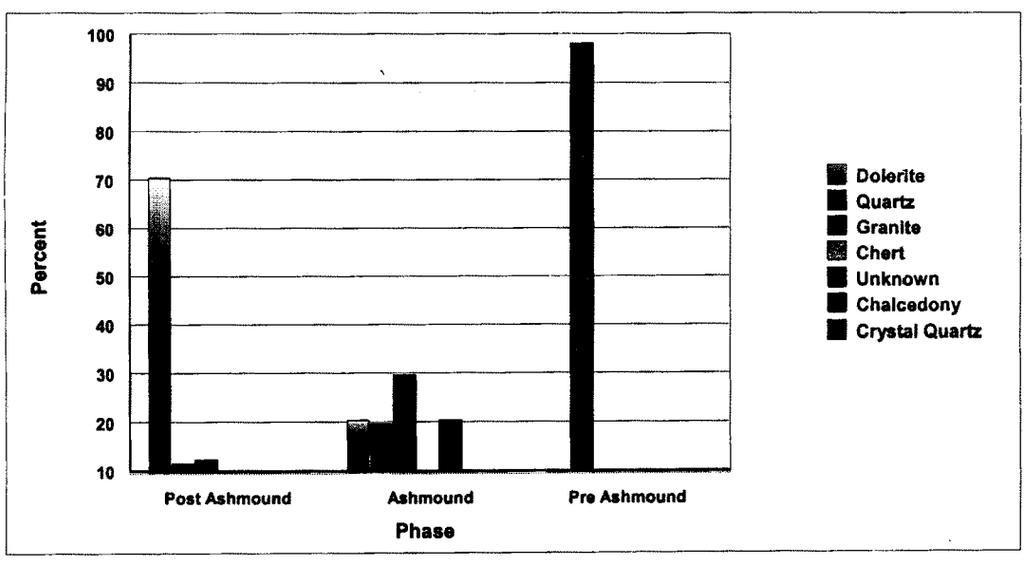

Figure 6.5.4. Raw Material in percentage from Initial and Pre-Ashmound Phase, San-04, Trench-10

Detailed analysis

Morphological variability within lithic assemblage. From Sannarachamma Gudda site a total of 129 artefacts were analyzed in a detailed way, out of these 129 artefacts, 100 (77.52 %) were flakes, 19 (14.73 %) were axes and 10 (7.75 %) were broken axes (Table 6.5.3).

Table 6.5.3. Frequency table from flaked piece types from Sannarachamma.

Flaked Piece Type	Frequency	Percent
Flake	100	77.52
Axes	19	14.73
Broken Axe	10	7.75
Total	**129**	**100**

General metrical measurements for axes types

Mean, standard deviation and coefficient of variation for general measurements like maximum dimension, maximum width, thickness and weight were recorded in order to explain the variability within axe size and shape from Sannarachamma Gudda.

Axe from 1158 context were longer (128.32 mm), thicker (35.04 mm) and heavier (42 mm), at when the width is considered, axes from 1183 context were the widest (70.29 mm) axe, whereas, axes from 1204 context were shorter (20.51 mm), thinner (4.43 mm) and lighter (3.6

mm) and the width is considered, axes from 1168 were the narrowest among all axes (Table 6.5.4).

Table 6.5.4. Mean, standard deviation coefficient of variation of general measurement for axes from Sannarachamma Gudda.

Context	Variables	Mean	Std. Deviation	CV
1014	Length	100.22	14.46	0.14
	Maximum Width	56.59	6.82	0.12
	Thickness	26.82	0.42	0.02
	Weight	174.35	71.63	0.41
1105	Length	104.35	0.00	0.00
	Maximum Width	58.85	0.00	0.00
	Thickness	23.36	0.00	0.00
	Weight	164	0.00	0.00
1118	Length	66.44	0.00	0.00
	Maximum Width	51.06	0.00	0.00
	Thickness	13.11	0.00	0.00
	Weight	51.9	0.00	0.00
1146	Length	77.95	26.12	0.34
	Maximum Width	64.96	8.64	0.13
	Thickness	29.78	19.43	0.65
	Weight	143.05	62.3	0.44
1147	Length	107.48	31.43	0.29
	Maximum Width	55.65	7.24	0.13
	Thickness	23.1	7.88	0.34
	Weight	185.08	137.2	0.74
1158	Length	128.32	45	0.35
	Maximum Width	62.59	13.19	0.21
	Thickness	35.04	13.21	0.38
	Weight	420	308.3	0.73
1168	Length	46.15	26.04	0.56
	Maximum Width	18.91	3235.16	1.71
	Thickness	17.87	19.98	1.12
	Weight	71.93	114.38	1.59
1183	Length	74.47	0.00	0.00
	Maximum Width	70.29	7.76	0.11
	Thickness	29.84	18.53	0.62
	Weight	177.2	122.75	0.69
1204	Length	20.51	0.00	0.00
	Maximum Width	20.51	0.00	0.00
	Thickness	4.43	0.00	0.00
	Weight	3.6	0.00	0.00

Influence of initial form on the variability observed in the axes

Table 6.5.5., was used in order to explain the effects of initial form on the size and shape of axes within a stratigraphic unit. When axe made from initial form were compared, axe made from slab were longer (128.32 mm), wider (62.59 mm), thicker (35.04 mm) and heavier (420 mm), whereas, axes made from flakes were narrower (50.69) and thinner (21.44 mm) and when the maximum dimension and weight is considered axes made from indeterminate were shorter (90 mm) and lighter (123.70 mm). When initial form are compared between the context, in context 1147, axes made from flakes were shorter, narrower, thinner and lighter, whereas, axe made from indeterminate are longer, wider, thicker and heavier.

Form 1014 context axes were made from slab and indeterminate, when a comparison was made between the axes made from each context, axes from 1147 made on slabs were longer, wider, thicker and heavier, whereas, axes made on indeterminate were shorter, narrower, thicker and heavier. Other context like 1105 and 1158 could not be compared because they were made from only one type of initial form. Figure 6.5.5 to 6.5.8., indicates that from Post-Ashmound Pitting phase the axes made from all the three initial forms i.e., slabs, flakes and

indeterminate are shorter, narrower, thinner and lighter than axes from Terminal Occupation of Sannarachamma site.

Table 6.5.5. Mean, standard deviation coefficient of variation of general measurement for axes broken down by its initial form from Sannarachamma Gudda.

Context	Initial Form	Variable	Mean	Std. Deviation	CV
1147	Flakes	Length	103.77	26.13	0.25
		Maximum Width	50.69	3.01	0.06
		Thickness	21.44	1.11	0.05
		Weight	135.15	43.63	0.32
	Indeterminate	Length	109.96	40.15	0.37
		Maximum Width	58.96	7.70	0.13
		Thickness	24.22	10.90	0.45
		Weight	218.37	180.39	0.83
1105	Indeterminate	Length	104.35	0.00	0.00
		Maximum Width	58.85	0.00	0.00
		Thickness	23.36	0.00	0.00
		Weight	164.00	0.00	0.00
1014	Slab	Length	110.45	0.00	0.00
		Maximum Width	61.41	0.00	0.00
		Thickness	27.12	0.00	0.00
		Weight	225.00	0.00	0.00
	Indeterminate	Length	90	0.00	0.00
		Maximum Width	51.76	0.00	0.00
		Thickness	26.52	0.00	0.00
		Weight	123.70	0.00	0.00
1158	Slab	Length	128.32	45.00	0.35
		Maximum Width	62.59	13.19	0.21
		Thickness	35.04	13.21	0.38
		Weight	420.00	308.30	0.73

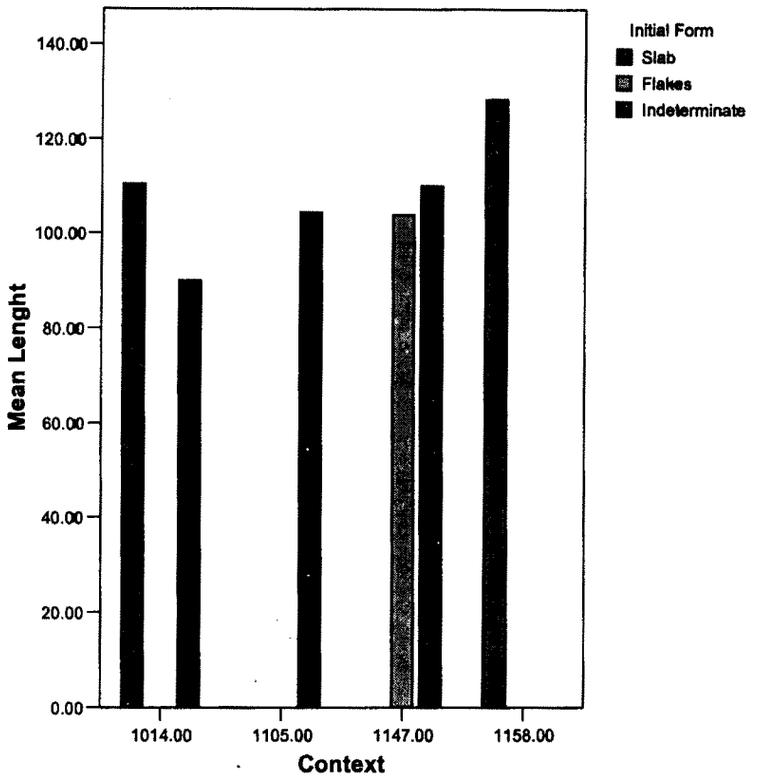

Figure 6.5.5. Mean length of axe broken down by initial form.

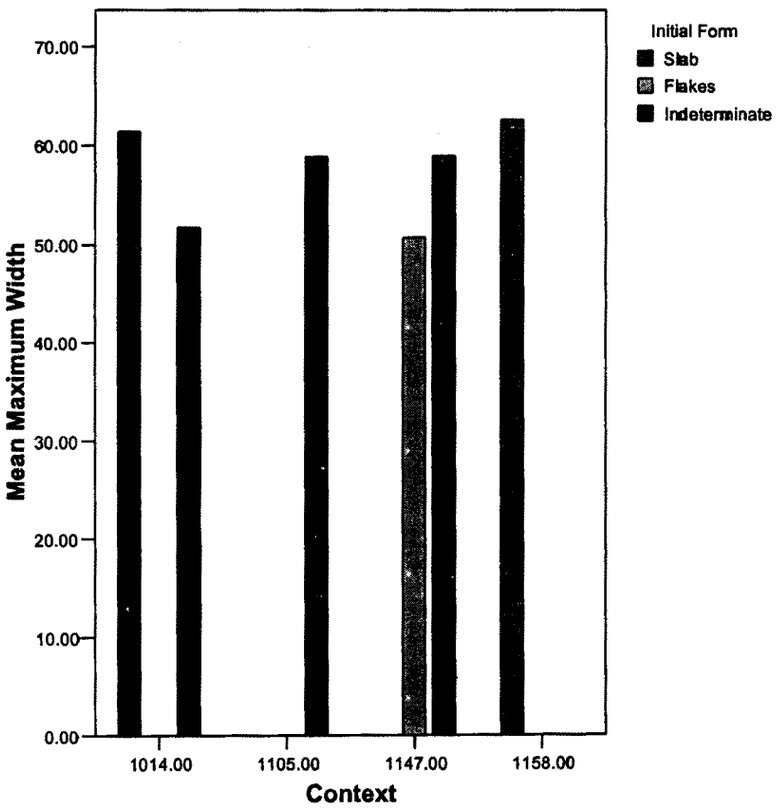

Figure 6.5.6. Mean maximum width of axe broken down by initial form.

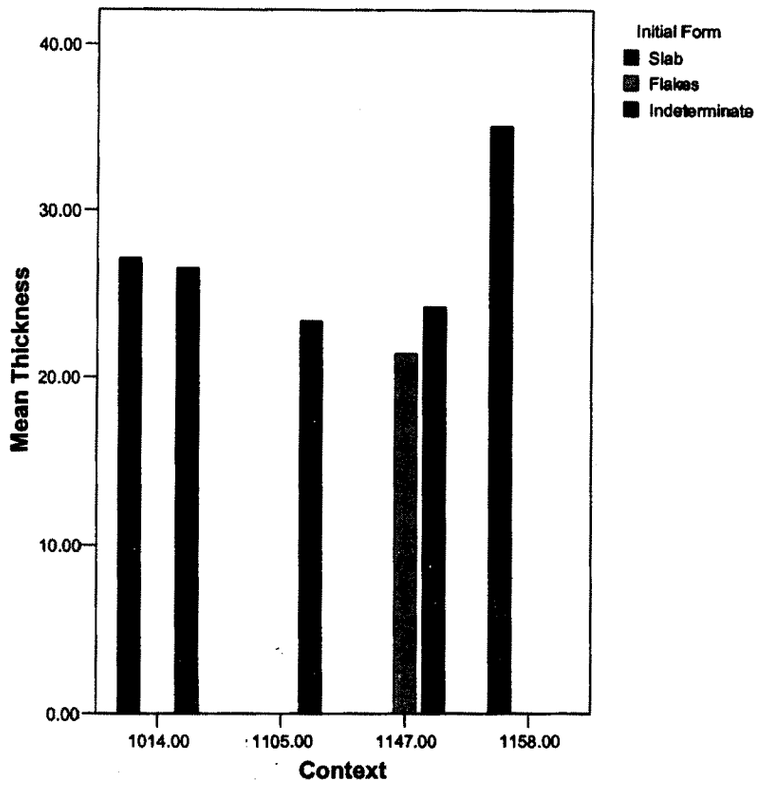

Figure 6.5.7. Mean thickness of axe broken down by initial form.

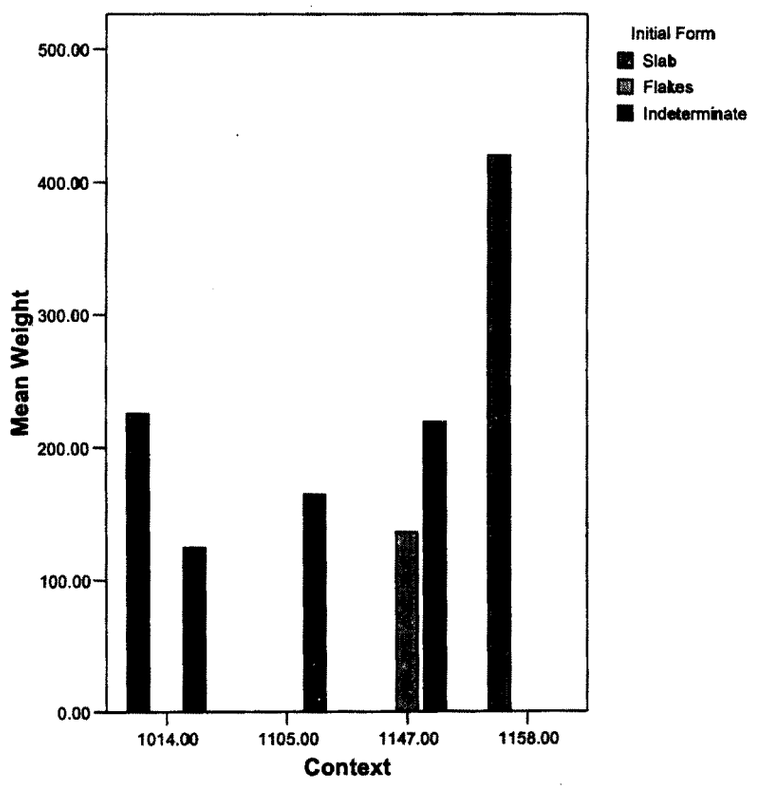

Figure 6.5.8. Mean weight of axe broken down by initial form.

Influence of cortex type on the variability observed in the axes

Cortex type was also recorded in order to test the effects of size and shape of raw materials on the variability in morphology of axes.

Only from 1147 context two types of calst were selected. So only from the 1147 context the effect of cortex type on the variability could be noticed. From 1147, axe made from angular clast type were longer, wider, thicker and heavier than axe made from sub-rounded clast type. When the axe are compared as whole in the this trench (Trench 10), axes made from sub-angular clast from 1158 context were longer, wider, thicker and heavier, whereas, axes made from angular clast type from 1168 context were shorter, narrower, thinner and lighter (Table 6.5.6). From Figure 6.5.9 to 6.5.12., it is clear that axe were made from angular, sub-angular and sub-rounded clast types. The selection of clast did not effect the morphology of the axes to a great extent, but, a pattern could be noticed in Figure 6.5.9 to 6.5.12., where, axes made from these three clast type were longer, wider, thicker and heavier in the Terminal Occupation of Sannarachamma phase (1158 and 1146 contexts) and Post-Ashmound Pitting phase (1105, 1118 and 1147 contexts) whereas, axes from Main Ashmound phase (1168 and 1204 contexts) are shorter, narrower, thinner and lighter.

Table 6.5.6. Mean, standard deviation coefficient of variation of general measurement for axes broken down by its initial form from Sannarachamma Gudda.

Context	Cortex Type	Variable	Mean	Std. Deviation	CV
1168	Angular	Length	25.84	0.00	0.00
		Maximum Width	25.84	0.00	0.00
		Thickness	7.66	0.00	0.00
		Weight	6.60	0.00	0.00
1118	Angular	Length	66.44	0.00	0.00
		Maximum Width	51.06	0.00	0.00
		Thickness	13.11	0.00	0.00
		Weight	51.90	0.00	0.00
1146	Angular	Length	59.14	0.00	0.00
		Maximum Width	71.07	0.00	0.00
		Thickness	16.04	0.00	0.00
		Weight	99.00	0.00	0.00
1147	Sub-Rounded	Length	95.81	0.00	0.00
		Maximum Width	53.32	0.00	0.00
		Thickness	22.52	0.00	0.00
		Weight	128.90	0.00	0.00
	Angular	Length	120.28	49.48	0.41
		Maximum Width	58.15	13.56	0.23
		Thickness	29.05	9.65	0.33
		Weight	265.15	227.48	0.86
1105	Angular	Length	104.35	0.00	0.00
		Maximum Width	58.85	0.00	0.00
		Thickness	23.36	0.00	0.00
		Weight	164.00	0.00	0.00
1014	Sub-Rounded	Length	90.00	0.00	0.00
		Maximum Width	51.76	0.00	0.00
		Thickness	26.52	0.00	0.00
		Weight	123.70	0.00	0.00
1158	Sub-Angular	Length	160.14	0.00	0.00
		Maximum Width	71.92	0.00	0.00
		Thickness	44.38	0.00	0.00
		Weight	638.00	0.00	0.00

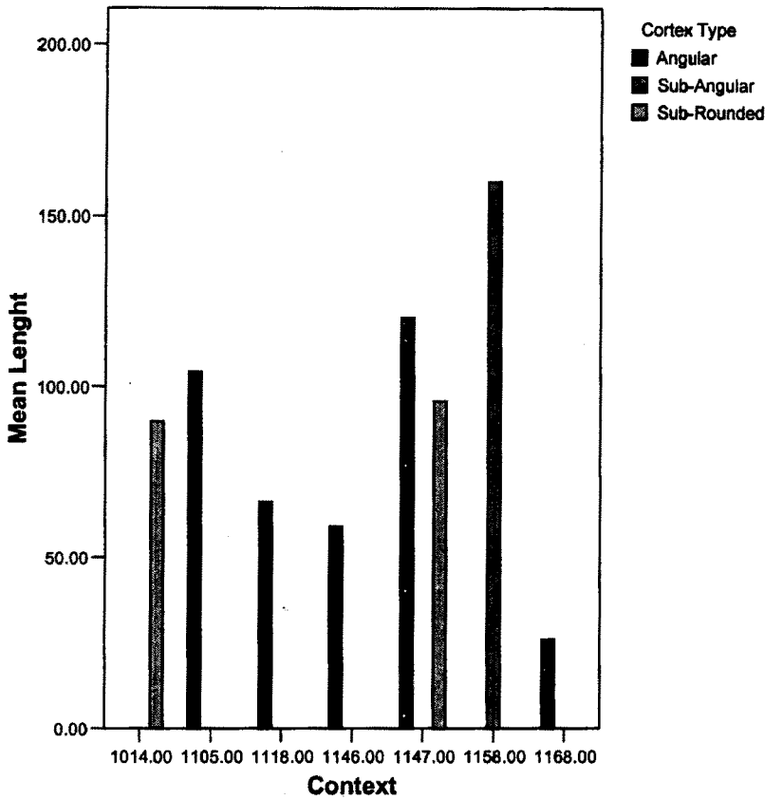

Figure 6.5.9. Mean length of axe broken down by cortex type.

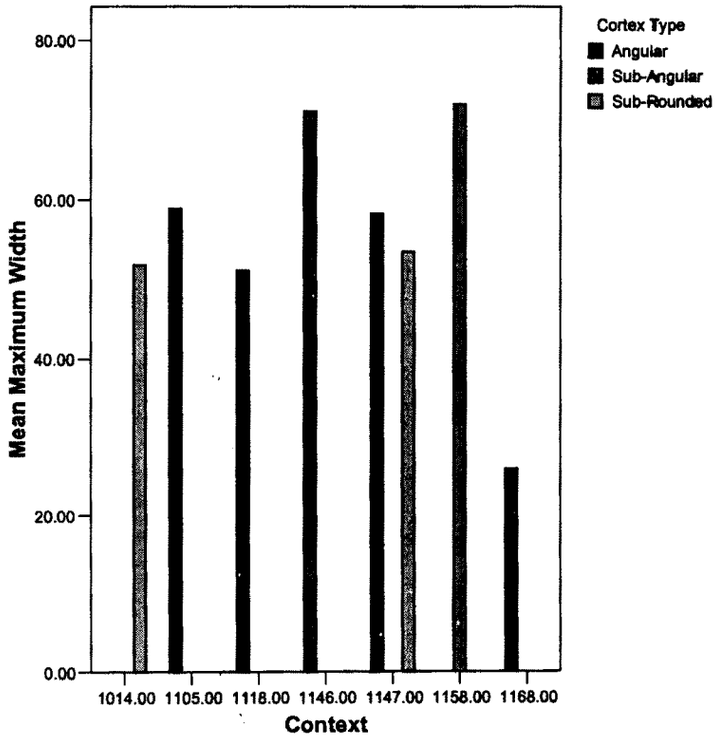

Figure 6.5.10. Mean maximum width of axe broken down by cortex type.

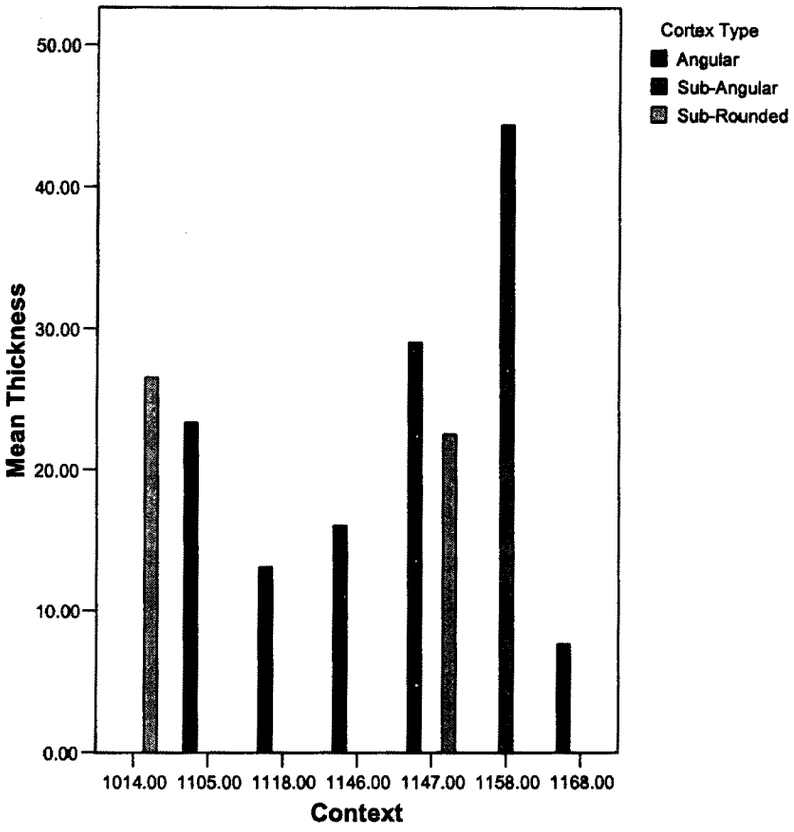

Figure 6.5.11. Mean thickness of axe broken down by cortex type.

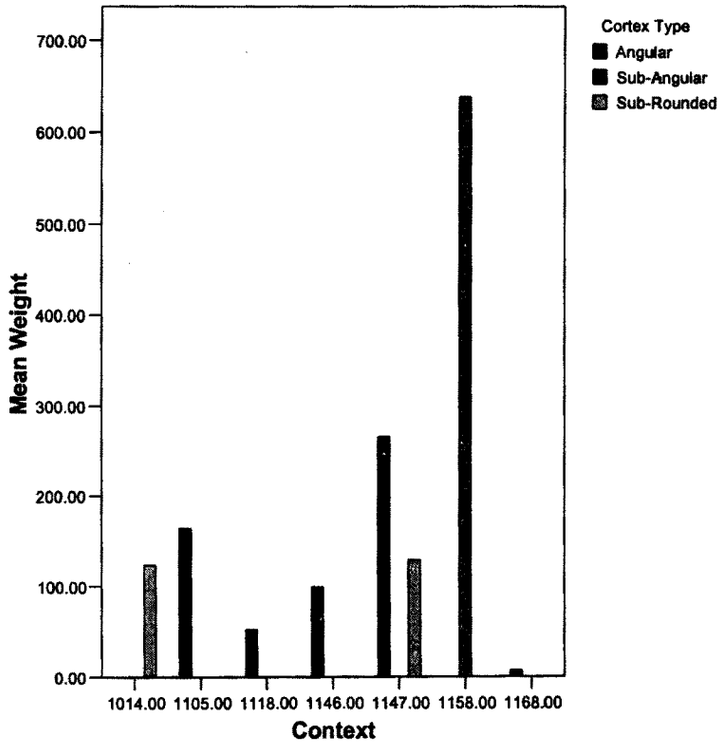

Figure 6.5.12. Mean weight of axe broken down by cortex type.

6.6. Lithic from Choudamma Gudda

Universal strategy

A total of 635 lithic artefacts were collected from Trench 1. As indicated in Table 1, the most commonly exploited raw material was quartz, which represented 60% of the total assemblage, followed by comparatively low percentage of dolerite (23.3%). Chert, chalcedony, granite, gabbro and crystal quartz constitute to remaining 20% of raw material from the total artifact count (Table 6.6.1). Though counts were low, it is interesting to note the wider diversity of raw material found in this site (Table 6.6.1).

From the early levels (30004, 30003, 30002 and 30001) of the habitation from this site, quartz remains the predominate raw material and in the later level (30000) it is replaced by dolerite.

Table 6.6.1 Artefact types by raw material from Trench 1, CHO-06.

Artefact Types	Raw Materials								Total
	Dolerite	Quartz	Chert	Chalcedony	Granite	Q.C	Un	Gabbro	
AS/BF and NFD	115 (24.21)	318 (66.94)	23 (4.84)	1 (0.21)	10 (2.10)	7 (1.47)	1 (0.21)	0 (0.00)	475
Early Reduction Flake	29 (50.00)	19 (32.75)	8 (13.79)	1 (1.72)	1 (1.72)	0 (0.00)	0 (0.00)	0 (0.00)	58
Bifacial Thinning Flake	1(100)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	1
Axe Reworking Flake	2 (100)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	2
Retouched Artefact	0 (0.00)	4 (22.22)	14 (77.77)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	18
Hammerstone	1 (20.00)	1 (20.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	3 (60.00)	5
Blade/Blade Segment	0 (0.00)	20 (39.21)	25 (49.01)	5 (9.80)	0 (0.00)	1 (100)	0 (0.00)	0 (0.00)	51
Blade Core	0 (0.00)	0 (0.00)	2 (66.66)	1 (33.33)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	3
Non Cultural	0 (0.00)	6 (100)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	6
Core	0 (0.00)	2 (100)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	2
Core Segment	0 (0.00)	11 (91.66)	0 (0.00)	0 (0.00)	0 (0.00)	1 (8.33)	0 (0.00)	0 (0.00)	12
Flake	0 (0.00)	0 (0.00)	1 (50.00)	1 (50.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	2
Total	148 (23.30)	381 (60.00)	73 (11.49)	9 (1.41)	11(1.73)	9 (1.41)	1(0.15)	3 (0.47)	**635**

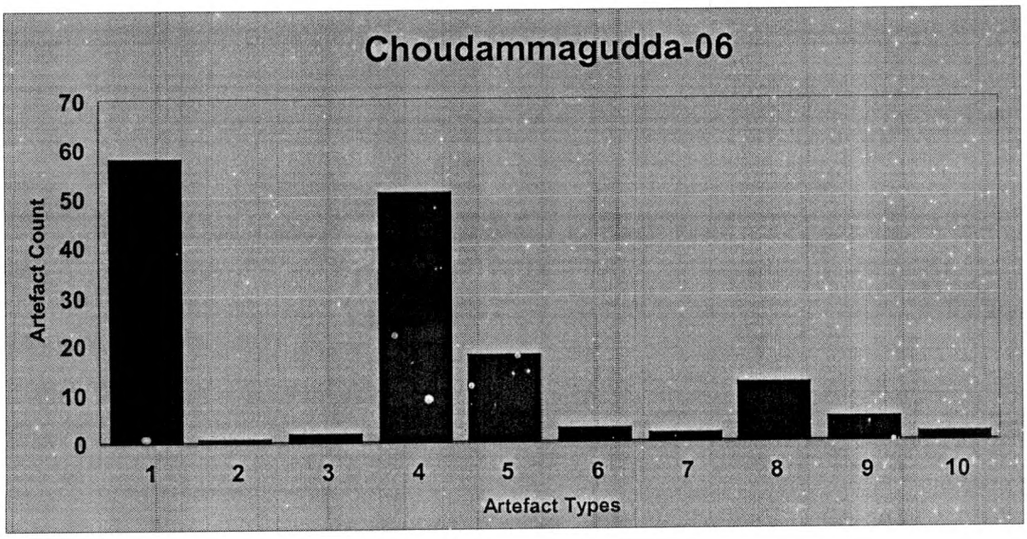

Figure 6.6.1 Artefact Type Count (1-Early reduction flake; 2-Bifacial thinning flake; 3-Axe reworking flake; 4-Blade; 5-Retouched artefact; 6-Blade core; 7-Core; 8-Core segment; 9-Hammerstone; 10-Flake from Trench-1, CHO-06.

Table 6.6.2 Raw material by context from Trench 1, CHO-06.

Context	Raw Material								Total
	Dolerite	Quartz	Chert	Chalcedony	Granite	Unknown	Gabbro	C. Q	
30000	62 (70.45)	18 (20.45)	3 (3.40)	2 (2.27)	0 (0.00)	1(1.13)	2 (2.27)	0 (0.00)	88
30001	56 (14.47)	249(64.34)	63 (16.27)	6 (1.55)	9 (2.32)	0 (0.00)	0 (0.00)	4 (1.03)	387
30002	9 (21.42)	25 (59.52)	5 (11.90)	1 (2.38)	0 (0.00)	0 (0.00)	0 (0.00)	2 (4.76)	42
30003	1 (1.75)	51 (89.47)	2 (3.50)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	3 (5.26)	57
30004	20 (32.78)	38 (62.29)	0 (0.00)	0 (0.00)	2 (3.27)	0 (0.00)	1 (1.63)	0 (0.00)	61
Total	148(23.3)	381(60)	73(11.4)	9(1.4)	11(1.7)	1(0.15)	3(0.47)	9(1.4)	635(100)

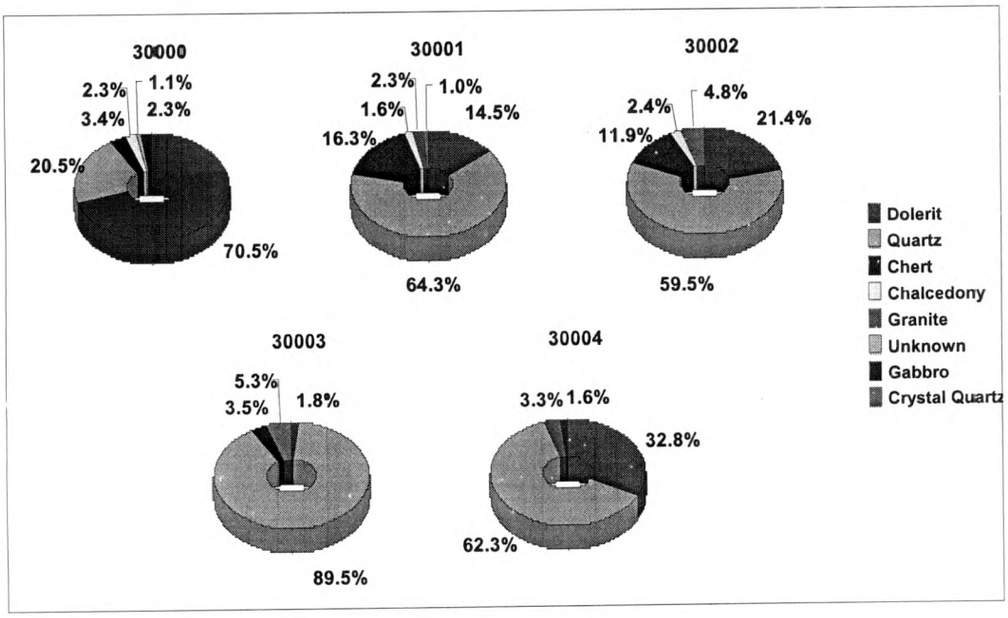

Figure 6.6.2. Raw Material by context from Trench-10, CHO-06.

In context 30000, dolerite was the predominant raw material (Table 6.6. 2). Among dolerite artefacts, flake shatter and early reduction flakes are the most common, indicating initial roughening out of the axe (Table 6.6. 3). The highest count of artifact occurs in 30001 contexts, whereas relatively lower percentages of artifacts were recovered in the lower and upper levels of this trench. Majority of blades and retouched artifacts were recovered from context 30001 (see Table 6.6. 3) made from chert and few were made from quartz. Very few number of blade cores were recovered from this context, signalling the fact that the chert blades and retouched artefacts were initially prepared in some other place and brought it to this place.

Table6.6.3 Artefact types by context from Choudmma Gudda.

Artefact Types	Context					Total
	30000	30001	30002	30003	30004	
AS/BF and NFD	62 (13.05)	282 (59.36)	23 (4.84)	50 (10.52)	58 (12.21)	475
Early Reduction Flake	16 (27.58)	30 (51.72)	7 (12.06)	3 (5.17)	2 (3.44)	58
Axe Reworking Flake	1 (50)	1 (50)	0 (0.00)	0 (0.00)	0 (0.00)	2
Bifacial Thinning Flake	1 (100)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	1
Hammerstone	4 (80)	0 (0.00)	0 (0.00)	0 (0.00)	1 (20)	5
Blade/Blade Segment	3 (5.88)	45 (88.23)	3 (5.88)	0 (0.00)	0 (0.00)	51
Blade Core	1 (33.33)	2 (66.66)	0 (0.00)	0 (0.00)	0 (0.00)	3
Retouched Artefact	0 (0.00)	15 (83.33)	2 (11.11)	1 (5.55)	0 (0.00)	18
Core	0 (0.00)	1 (50)	0 (0.00)	1 (50)	0 (0.00)	2
Core Segment	0 (0.00)	5 (41.66)	5 (41.66)	2 (16.66)	0 (0.00)	12
Flake	0 (0.00)	0 (0.00)	2 (100)	0 (0.00)	0 (0.00)	2
Non-cultural	0 (0.00)	6 (100)	0 (0.00)	0 (0.00)	0 (0.00)	6
Total	88 (13.85)	387 (60.94)	42 (6.61)	57 (8.97)	61 (9.60)	635

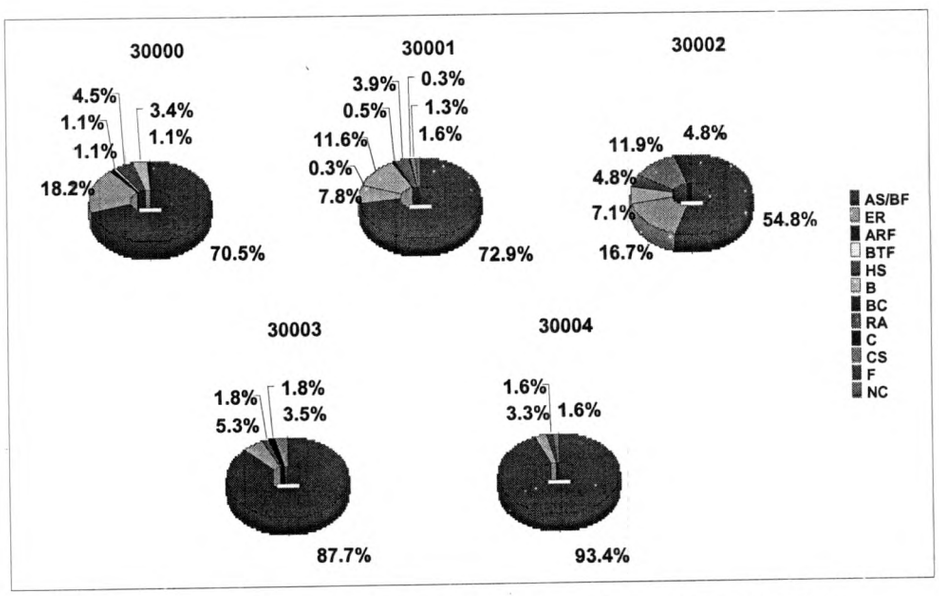

Figure 6.6.3. Artefact types by context from Trench 1, CHO-06.

6.7. Lithic from Birappa rock shelter

A total of 32,818 lithic artefacts were collected from five trenches. Indicating spatial variability in site activities, lithic artefact count were variable, ranging from a high of 20,486 in Trench 5 to a low of 281 artefacts in Trench 6. Trenches 1 (n=8,253), 2 (n=3,096), 3 (n=702) and 5 (n=20,486) showed variations in lithic artefact density. As Trench 2 and 5 experienced the least amount of disturbance, more detailed analysis has been performed on these artefacts.

Table 6.7.1. Artefact types by raw material from Trench 1, 2 and 5 (BIR-04)

Artefact Types	Total									
	Dolerite	Quartz	Chert	Chalcedony	Granite	Un	Quartzite	Slag	Ochre	
AS/BF and NFD	58(0.34)	16386(97.32)	237(1.40)	77 (0.45)	11(0.06)	57(0.33)	11(0.06)	0 0.00)	0 0.00)	16837
Early Reduction Flake	13 (86.66)	0 (0.00)	2 (13.33)	0 (0.00)	0 0.00)	0 0.00)	0 (0.00)	0 0.00)	0 0.00)	15
Bifacial Thinning Flake	1 (100)	0 (0.00)	0 (0.00)	0 (0.00)	0 0.00)	0 0.00)	0 (0.00)	0 0.00)	0 0.00)	1
ARF	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 0.00)	0 0.00)	0 (0.00)	0 0.00)	0 0.00)	0
RDF	0 (0.00)	4 (80)	1 (20)	0 (0.00)	0 0.00)	0 0.00)	0 (0.00)	0 0.00)	0 0.00)	5
RA	0 (0.00)	234 (93.22)	10 (3.98)	6 (2.39)	0 0.00)	1 (0.39)	0 (0.00)	0(0.00)	0 0.00)	251
MC	1 (0.51)	180 (93.26)	10 (5.18)	1 (0.51)	0 0.00)	1 (0.51)	0 (0.00)	0 0.00)	0 0.00)	193
SC	0 (0.00)	4 (80)	0 (0.00)	0 (0.00)	0 0.00)	0 0.00)	1(20)	0 0.00)	0 0.00)	5
AB	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 0.00)	0 0.00)	0 (0.00)	0 0.00)	0 0.00)	0
Axe	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 0.00)	0 0.00)	0 (0.00)	0 0.00)	0 0.00)	0
EGC	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 0.00)	0 0.00)	0 (0.00)	0 0.00)	0 0.00)	0
Other	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 0.00)	0 0.00)	0 (0.00)	6 28.57)	15 (71.42)	21
AC	0 (0.00)	5(100)	0 (0.00)	0 (0.00)	0 0.00)	0 0.00)	0 (0.00)	0 0.00)	0 (0.00)	5
Un	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 0.00)	0 0.00)	0 (0.00)	0 0.00)	0 (0.00)	0
HS	2 (14.28)	9 (64.28)	0 (0.00)	0 (0.00)	0 0.00)	2 14.28)	1 (7.14)	0 0.00)	0 (0.00)	14
M	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 0.00)	0 0.00)	0 (0.00)	0 0.00)	0 (0.00)	0
G	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	7 63.63)	4 36.36)	0 (0.00)	0 0.00)	0 (0.00)	11
R	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 0.00)	0 0.00)	0 (0.00)	0 0.00)	0 (0.00)	0
B	1 (0.22)	374 (83.85)	53 11.88)	14 (3.19)	0 0.00)	4 (0.89)	0 (0.00)	0 0.00)	0 (0.00)	446
BC	0 (0.00)	127 (95.48)	5 (3.75)	1 (0.75)	0 0.00)	0 0.00)	0 (0.00)	0 0.00)	0 (0.00)	133
MD	0 (0.00)	470 (95.72)	0 (0.00)	21(4.27)	0 0.00)	0 0.00)	0 (0.00)	0 0.00)	0 (0.00)	491
CR	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 0.00)	0 0.00)	0 (0.00)	0 0.00)	0 (0.00)	0
NC	3 (23.07)	0 (0.00)	0 (0.00)	1 (7.69)	0 0.00)	9 69.23)	0 (0.00)	0 0.00)	0 (0.00)	13
Core	1 (4.76)	17(80.95)	2 (9.52)	1 (4.76)	0 0.00)	0 0.00)	0 (0.00)	0 0.00)	0 (0.00)	21
CS	0 (0.00)	248(99.2)	1(0.4)	1(0.4)	0 0.00)	0 0.00)	0 (0.00)	0 0.00)	0 (0.00)	250
BiC	0 (0.00)	21(100)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	21
F	17 (1.25)	1232 (90.65)	54 (3.97)	40 (2.94)	3 (0.22)	7 (0.51)	6 (0.44)	0 (0.00)	0 (0.00)	1359
Total	**97 (0.48)**	**19311 (96.11)**	**375 (1.86)**	**163 (0.81)**	**21 (0.10)**	**85 (0.42)**	**19 (0,09)**	**6 (0.02)**	**15 (0.07)**	**20092(99.96)**

As demonstrated in Trench 2, the most commonly exploited raw material was quartz, which represented 98.4% of the total assemblage, followed by low percentages of dolerite, chert and chalcedony (Table 6.7.1). Though counts were low, it is interesting to note the wider diversity of raw material found in the younger deposit, which included the appearance of dolerite (Table 6.7.1). Indicative of variable intensity of site use, the highest count of artifacts occur in Spit 6, whereas relatively lower percentages of artifacts were recovered in the lower and upper levels (spits) of this trench. Of note in Spit 6 is the recovery of a high number of multi-platform cores, blade core and core segments, as well as relatively high counts of blades and retouched artifacts, signalling the production of backed artifacts (Table 6.7.2). Most of the backed artifacts has one or two longitudinal ridges on the dorsal surface and has a triangular, sub-triangular or trapezoidal transverse or cross section, suggesting the production of backed artifacts from blade.

Table 6.7. 2. Raw material count by spit from Trench-2, BIR-04.

Context	Raw Material					Total
	Dolerite	Quartz	Chert	Chalcedony	Unknown	
5005 sp-3	2 (28.57)	2 (28.57)	3 (42.85)	0 (0.00)	0 (0.00)	7
5010 sp-4	1 (0.17)	561 (99.29)	3 (0.53)	0 (0.00)	1 (0.17)	565
5020 sp-6	1 (0.06)	1474 (98.85)	11 (0.73)	4 (0.26)	1 (0.06)	1491
5022 sp-7	0 (0.00)	207 (94.95)	2 (0.91)	0 (0.00)	9 (4.12)	218
5035 sp-8	0 (0.00)	27 (100)	0 (0.00)	0 (0.00)	0 (0.00)	27
5040 sp-9	0 (0.00)	87 (100)	0 (0.00)	0 (0.00)	0 (0.00)	87
Total	4(0.16)	2357 (98.4)	19(0.79)	4(0.16)	11(0.45)	2395(100)

Table 6.7 3. Artefact types by spit from Trench-2, BIR-04.

Artefact Types	Context						Total
	5005	5010	5020	5022	5035	5040	
AS/BF and NFD	3 (42.8)	531 (939)	1317(88.4)	200(91.7)	23(85.1)	87(100)	2161(90.3)
Early Reduction Flake	0 (0.00)	0 (0.00)	2(0.13)	0 (0.00)	0 (0.00)	0 (0.00)	2(0.08)
Redirecting Flake	0 (0.00)	0 (0.00)	2(0.13)	0 (0.00)	0 (0.00)	0 (0.00)	2(0.08)
Multi-platform Core	1(14.2)	6(1.06)	19(1.2)	0 (0.00)	1(3.7)	0 (0.00)	27(1.1)
Assayed Cobble	1(14.2)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	1(0.04)
Hammerstone	1(14.2)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	1(0.04)
Grinding stone	0 (0.00)	1(0.17)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	1(0.04)
Blade/Blade Segment	0 (0.00)	3(0.05)	25(1.6)	1(0.45)	3(11.1)	0 (0.00)	31(1.2)
Blade Core	1(14.2)	2(0.35)	5(0.33)	1(0.45)	0 (0.00)	0 (0.00)	9(0.37)
Non Cultural	0 (0.00)	0 (0.00)	0 (0.00)	9(4.12)	0 (0.00)	0 (0.00)	9(0.37)
Retouched Artefact	0 (0.00)	0 (0.00)	20(1.3)	1(0.45)	0 (0.00)	0 (0.00)	21(0.87)
Core Segment	0 (0.00)	15(2.6)	79(5.3)	1(0.45)	0 (0.00)	0 (0.00)	95(3.9)
Flake	0 (0.00)	7(1.2)	20(1.3)	5(2.2)	0 (0.00)	0 (0.00)	32(1.3)
Total	**7(100)**	**565(100)**	**1489(100)**	**218(100)**	**27(100)**	**87(100)**	**2393(100)**

Trench-5 contained the highest number of artefacts (n=20,486) from excavated contexts. Like Trench 2, quartz was the predominant raw material, consisting of 96% of the total analysed artefacts (Table 6.7.3). Unlike Trench 2, a high count of artefacts was recovered in upper Spit 3, with a decreasing number of artefacts with increasing depth. Other raw materials were found in low percentages, and in all spits, suggesting procurement of a range of material in all time periods. Similar to 5020 (Spit 6) of Trench 5, a high number of multi-platform cores, blade cores and score segments, as well as relatively high counts of blades and retouched artefacts, signalling the production of backed artefacts (Table 6.7.3).

Table 6.7 4. Raw material count with in the Spits from Trench-5, BIR-04

Context	RawMaterial							Total
	Dolerite	Quartz	Chert	Chalcedony	Granite	Unknown	Quartzite	
5016 sp-3	9 (0.19)	4489 (97.05)	94 (2.03)	12 (0.25)	0 (0.00)	19 (0.41)	2 (0.04)	4625
5018 sp-4	4 (6.89)	18 (31.03)	36 (62.06)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	58
5023 sp-6	6 (0.22)	2577 (95.65)	83 (3.08)	13 (0.48)	2 (0.07)	12 (0.44)	1 (0.03)	2694
5030 sp-9	2 (0.09)	2139 (98.02)	30 (1.37)	3 (0.13)	0 (0.00)	7 (0.32)	1 (0.04)	2182
Total	**21(0.21)**	**9223(96.4)**	**243(2.54)**	**28(0.29)**	**2(0.02)**	**38(0.39)**	**4(0.04)**	**9559(100)**

Table 6.7.5. Lithic Assemblage from Trench-5, BIR-04

Artefact Types	Context				Total
	5016	5018	5023	5030	
AS/BF and NFD	4265(92.2)	54(93.1)	2510(93.1)	1985(90.9)	8814(92.2)
Redirecting Flake	0 (0.00)	0 (0.00)	3(0.11)	0 (0.00)	3(0.03)
Multi-platform Core	38(0.82)	0 (0.00)	9(0.33)	24(1.09)	71(0.7)
Assayed Cobble	2(0.04)	0 (0.00)	0 (0.00)	0 (0.00)	2(0.02)
Hammer stone	3(0.06)	0 (0.00)	0 (0.00)	1(0.04)	4(0.04)
Grinding stone	1(0.02)	0 (0.00)	2(0.07)	0 (0.00)	3(0.03)
Blade/Blade Segment	124(2.6)	3(5.1)	73(2.7)	54(2.4)	254(2.6)
Blade Core	19(0.41)	0 (0.00)	10(0.37)	20(0.91)	49(0.5)
Retouched Artefact	54(1.1)	0 (0.00)	24(0.89)	43(1.9)	121(1.2)
Core Segment	44(0.95)	0 (0.00)	20(0.74)	22(1)	86(0.8)
Bipolar Core	3(0.06)	0 (0.00)	0 (0.00)	0 (0.00)	3(0.03)
Flake	72(1.5)	1(1.7)	43(1.59)	33(1.5)	149(1.5)
Total	**4625(100)**	**58(100)**	**2694(100)**	**2182(100)**	**9559(100)**

6.8. Cores from Birappa rock shelter

A total of 123 cores were collected from this site and this site has been divided into two phases namely Early and Late phase, on the basis of occurrence of pottery and the occurrence of axes. Core types compared between early and late phase from Birappa rock shelter and were classified as blade let cores, blade core, flake core and blade and flake core were explained by percentage. This table indicates that the blade core types were high in Birappa's early phase and in Birappa's

late phase it was low. In early phase the frequency of blade cores were higher than that from Birappa's later phase and from the later phase, bladelet cores started to appear, and these bladelet cores were absent from the early phase of Birappa site (Figure 6.8.1). Frequency of flake cores id higher in the late phases that from early phase.

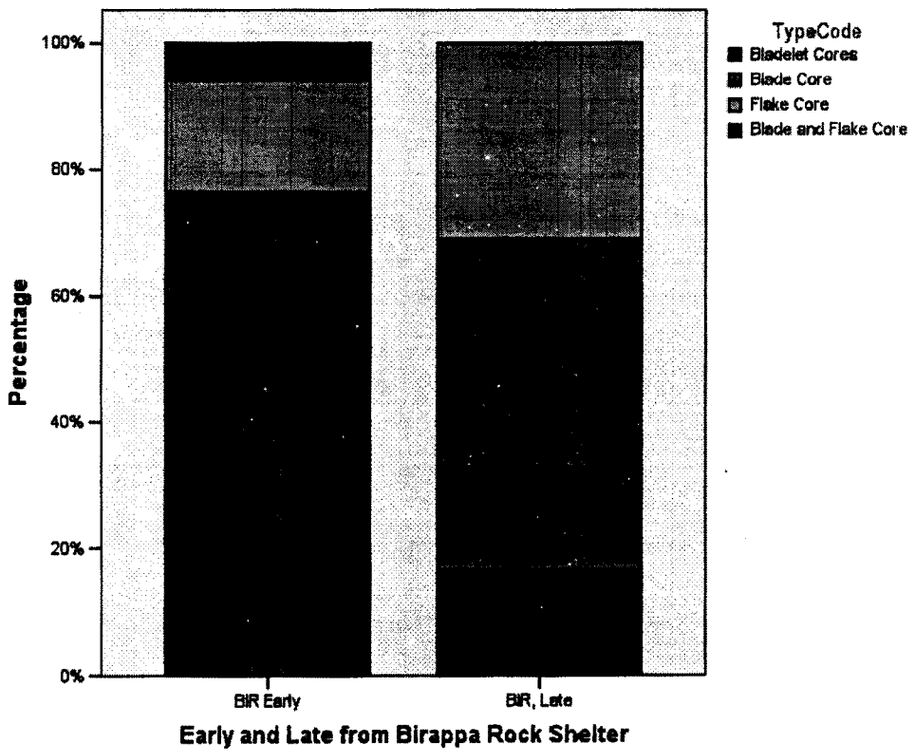

Figure 6.8.1. Frequency of types of cores from the early and late phase from Birappa.

When the technique of removing the flakes from the cores is compared between the phases, from the early phase majority of flakes were removed by using unidirectional flaking and from the late phase there is increase in the bidirectional flaking, bipolar flaking and multidirectional flaking than the early phase. From the late phase radial

flaking was introduced in order to remove the flakes and this technique was absent in the early phase (Figure 6.8.2).

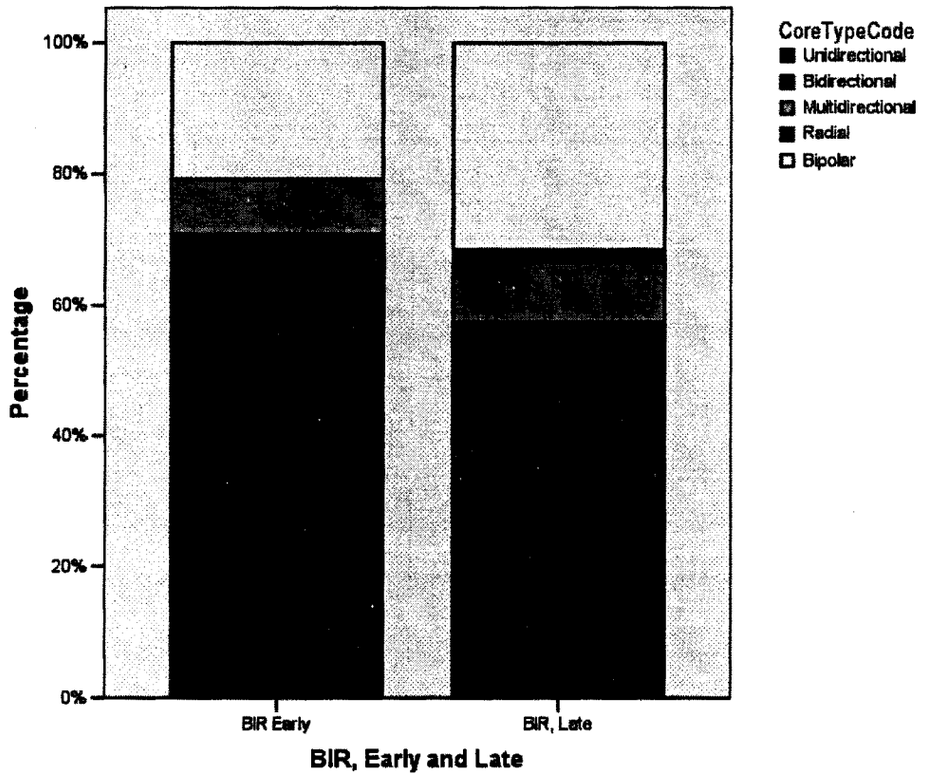

Figure 6.8.2. Frequency of types of cores from the early and late phase from Birappa.

6.9. HGD Area J

Universal strategy

A total of 7,634 lithic artefacts were collected from Trench 1 and 2. Trench 1 provided the most important information on the quarrying accept and a controlled section scraping was done and was numbered as Trench-2. As indicated in Table 6.9.3, the most commonly exploited raw material was dolerite, which comprised 97.3% of the total artefact (3,073) analysed.

Table 6.9.1 Total no of artefacts recovered from HGD-J, Trench1

Trench	Context	Count
1	20000	183
1	20001	734
1	20002	377
1	20003	908
1	20004	3133
1	20005	1761
	Total	**7096**

Table 6.9.2 Total no of artefacts recovered from HGD-J, Trench 2 (Section scraping)

Trench	Context	Count
2	20500	28
2	20501	90
2	20502	420
	Total	**538**

Table 6.9.3. Artefact types by raw material from Trench 1 and 2(HGD-J)

Artefact Types	Raw Materials				Total
	Dolerite	Quartz	Granite	Gabbro	
AS/BF and NFD	2196(71.4)	1(0.03)	66(2.1)	1(0.03)	2264
Early Reduction Flake	748(24.34)	0 (0.00)	11(0.35)	0 (0.00)	759
Bifacial Thinning Flake	17(0.55)	0 (.00)	0 (0.00)	0 (0.00)	17
Axe Blank	13(0.42)	0 (0.00)	0 (0.00)	0 (0.00)	13
Axe	2(0.06)	0 (0.00)	0 (0.00)	0 (0.00)	2
Edge Grounded "Chisel"	1(0.03)	0 (0.00)	0 (0.00)	0 (0.00)	1
Assayed Cobble	7(0.22)	0 (0.00)	0 (0.00)	0 (0.00)	7
Hammerstone	4(0.13)	0 (0.00)	2(0.06)	1(0.03)	7
Core	3(0.09)	0 (0.00)	0 (0.00)	0 (0.00)	3
Total	**2991 (97.33)**	**1 (0.03)**	**79 (2.57)**	**2 (0.06)**	**3073(100)**

Among dolerite artefacts, flake shatter (71.46%) and early reduction flakes (24.34%) are the most common, indicating initial roughening out of the axe. The recovery of low number of flakes representative of later stage of reduction (0.55%) indicates that this area was a quarry place.

The lithic assemblage from the Trench-1 is different from the lithic from Trench-2. On the southern side the assemblage from the section scraping appeared to be probably a dump of the smaller pit, which was eroding, downwards with the slope of the hill. The lithic artifacts recovered from Trench 2 were resulting from the reduction of

sub-rounded and sub-angular clasts. There are a very small percentage of artifacts made from slabs (Figure 6.9.1).

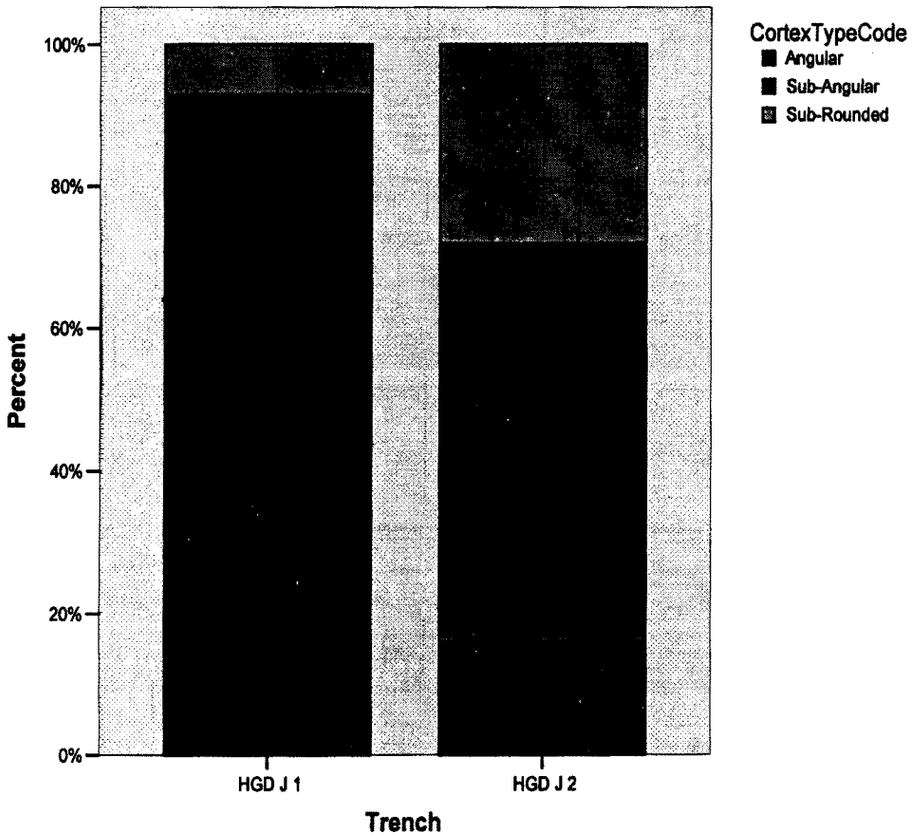

Figure 6.9.1. Cortex Type from HGD-J, Trench 1 and 2)

- As indicated from Figure 1, majority of lithic artifacts recovered from Trench 1 were resulting from the reduction of slab itself. There are a very small percentage of artifacts resulting from sub-angular and sub-rounded clasts.
- As it is obvious from Figure 1, the selection of clasts at a intra-site level the difference between the two lithic assemblages are well evident.

- Looking at the differences between these two assemblages from Area-J, one is reminded of the assemblages of Area-B (Upper Quarry site) and Area-A, Feature-1. The Area-B, Tr-1(Upper Quarry site) is similar to Area-J, Tr-2 and similarities between the procurement of clast from Area-J; Tr-1 is similar to that of Area-A, Feature-1.

Detailed analysis

Morphological variability within lithic assemblage. Table 6.9.4 explains the influence of cortex type on the variability observed in the axes. From Trench 1 of Area J, axes were made from three clast types namely angular, sub-angular and sub-rounded. Table 6.9.4 it is clear that axes made from sub-angular clast were longer, wider, thicker and heavier that the axes made from angular and sub-rounded clast type. Axes made from sub-rounded clast types were the shortest, narrowest, thinnest and lightest than the angular clast type.

Table 6.9.4. Mean, standard deviation and coefficient of variation of general metrical measurements of axe by cortex type.

Cortex Type	Variable	Mean	Std. Deviation	CV
Sub-Rounded	Length	95.18	0.00	0.00
	Maximum Width	60.65	0.00	0.00
	Thickness	35.89	0.00	0.00
	Weight	204.00	0.00	0.00
Angular	Length	106.16	14.14	0.13
	Maximum Width	67.18	9.01	0.13
	Thickness	34.51	18.25	0.53
	Weight	246.13	246.19	1.00
Sub-Angular	Length	139.87	33.57	0.24
	Maximum Width	80.53	38.91	0.48
	Thickness	54.57	18.79	0.34
	Weight	757.00	739.63	0.98

Influence of initial form on the variability observed in the axes. From Trench 1 of Area J, axes were made from four types of initial forms, namely slab, blocky, flake and indeterminate. Table 6.9.6 clearly indicates that axes made from blocky initial forms are longer, wider, thicker and heavier, whereas, axes made from flakes were shortest, thinnest and lightest. When the width is taken into account, axes made from indeterminate were the narrowest than all other axes.

Table 6.9.5. Mean, standard deviation and coefficient of variation of general metrical measurements of axe by initial form.

Initial Form	Variable	Mean	Std. Deviation	CV
Slab	Length	113.62	0.00	0.00
	Maximum Width	66.32	0.00	0.00
	Thickness	28.99	0.00	0.00
	Weight	271.00	0.00	0.00
Blocky	Length	142.89	29.30	0.21
	Maximum Width	92.66	21.75	0.23
	Thickness	61.72	8.69	0.14
	Weight	893.00	547.30	0.61
Flakes	Length	99.03	5.18	0.05
	Maximum Width	57.43	9.72	0.17
	Thickness	23.55	1.29	0.05
	Weight	69.15	74.60	1.08
Indeterminate	Length	102.11	9.68	0.09
	Maximum Width	57.28	3.65	0.06
	Thickness	32.01	8.06	0.25
	Weight	213.48	15.29	0.07

HGD J, Trench-2

Influence of cortex type on the variability observed in the axes. From Trench 2 of Area J, axes were made from three clast types namely angular, sub-angular and sub-rounded. Table 6.9.6., it is clear that axes made from angular clast were longer, thicker and heavier than axes made from sub-angular and sub-rounded clast type. But, when the width is taken into account, axes made from sub-angular clast types were widest. Axes made from sub-angular clast types were the shortest and thinnest, whereas, axes made from sub-rounded clast type were narrowest and lightest.

Table 6.9.6. Mean, standard deviation and coefficient of variation of general metrical measurements of axe by cortex type.

Cortex Type	Variable	Mean	Std. Deviation	CV
Sub-Angular	Length	77.34	37.91	0.49
	Maximum Width	63.36	0.64	0.01
	Thickness	21.11	17.18	0.81
	Weight	133.05	135.69	1.02
Sub-Rounded	Length	92.94	0.00	0.00
	Maximum Width	50.49	0.00	0.00
	Thickness	23.71	0.00	0.00
	Weight	126.50	0.00	0.00
Angular	Length	143.74	2.77	0.02
	Maximum Width	57.79	4.96	0.09
	Thickness	36.96	2.74	0.07
	Weight	277.50	10.61	0.04

Influence of initial form on the variability observed in the axes. From Trench 2 of Area J, axes were made from four types of initial forms, namely blocky, flake and indeterminate. Table 6.9.7., clearly indicates that axes made from flake as their initial form were shorter, wider, thicker and heavier, whereas, axes made from blocky were longer and narrowest. When the thickness and weight is taken into account, axes made from indeterminate were the thinnest and lightest.

Table 6.9.7. Mean, standard deviation and coefficient of variation of general metrical measurements of axe by initial form.

Initial code	Variable	Mean	Std. Deviation	CV
Flakes	Length	109.67	7.82	0.07
	Maximum Width	77.17	20.17	0.26
	Thickness	36.30	4.31	0.12
	Weight	322	131.52	0.41
Indeterminate	Length	109.80	27.71	0.25
	Maximum Width	54.93	5.66	0.10
	Thickness	31.27	7.59	0.24
	Weight	187.50	74.13	0.40
Blocky	Length	145.70	0.00	0.00
	Maximum Width	54.28	0.00	0.00
	Thickness	35.02	0.00	0.00
	Weight	285	0.00	0.00

6.10. HGD-04, Area-B

Universal strategy

A total of 2,420 lithic artefacts were recovered from Trench 1, 2, 3 and 4. From this total count of artefact, 2007 (82.93%) artefacts were analyzed universally and detailed measurements were taken for 297 artefacts (12.27%).

Trench 1 provides the most important stratigraphic information; hence analysis has been performed on the 1,262 lithic artifacts recovered from this trench. In Trench-1 dolerite was the most preferred and dominate raw material exploited.

Table 6.10.1. Artefact types by raw material count from Trench 1.

Artefact Types	Raw Materials										Total
	Dolerite	Quartz	Chert	Chalcedony	Granite	Q.C	Un	Quartzite	Slag	Ochre	
FS	922 (99.46)	2 (0.21)	0 (0.00)	1 (0.10)	2 (0.21)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	927
AS/BF and NFD	49 (100)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	49
ER	245 (99.19)	0 (0.00)	0 (0.00)	1 (0.40)	1 (0.40)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	247
BTF	13 (100)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	13
ARF	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0
RDF	2 (100)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	2
RA	14 (93.33)	1 (6.66)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	15
MC	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0
SC	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0
AB	3 (100)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	3
Axe	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0
EGC	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0
Other	1 (100)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	1
AC	1 (100)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	1
Un	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0
HS	3 (100)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	3

Contd.....

M	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0
G	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	1 (100)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	1
R	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0
B	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0
BC	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0
MD	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0
CR	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0
NC	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0
Core	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0
CS	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0
BC	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0
F	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0 (0.00)	0
Total	**1253 (99.28)**	**3 (0.23)**	**0 (0.00)**	**2 (0.15)**	**4 (0.31)**	**0 (0.00)**	**0 (0.00)**	**0 (0.00)**	**0 (0.00)**	**0 (0.00)**	**1262(99.97)**

As indicated in Table 6.10.1., the most exploited raw material was dolerite, which comprises 1,253 of the total artefact (1,262) analysed. Among dolerite artefacts, flake shatter and early reduction flakes are the most common, indicating initial roughening out of the axe. The recovery of low number of flakes representative of later stage of reduction indicates that this area was a quarry place. From this trench four quern stones were collected, and it is interesting to note that the four granite artefacts were analyzed might have resulted from the manufacture of these Quern Stones.

HGD B, Trench-1

Morphological variability within lithic assemblage. Table 6.10.2., explains the influence of cortex type on the variability observed in the axes. From Trench 1 of Area B, axes were made from three clast types namely angular, sub-rounded and rounded. Table 6.10.2., it is clear that axes made from sub-rounded clast were longer, wider, thicker and heavier than axes made from angular and rounded clast type, whereas, axes made from rounded clast types were the shortest, narrowest, thinnest and lightest.

Table 6.10.2. Mean, standard deviation and coefficient of variation of general metrical measurements of axe by cortex types.

Cortex Type	Variable	Mean	Std. Deviation	CV
Sub-Rounded	Length	48.35	24.27	0.50
	Maximum Width	32.57	10.89	0.33
	Thickness	10.75	4.76	0.44
	Weight	29.09	30.77	1.06
Angular	Length	23.85	18.55	0.78
	Maximum Width	30.12	19.30	0.64
	Thickness	7.13	5.82	0.82
	Weight	9.25	12.09	1.31
Rounded	Length	14.66	0.00	0.00
	Maximum Width	13.19	0.00	0.00
	Thickness	3.69	0.00	0.00
	Weight	0.90	0.00	0.00

Influence of initial form on the variability observed in the axes. From Trench 1 of Area B, axes were made from two types of initial forms, namely slab and indeterminate. Table 6.10.3., clearly indicates that axes made from indeterminate as their initial form were longer, wider, thicker and heavier, whereas, axes made from slab are shortest, narrowest, thinnest and lightest.

Table 6.10.3. Mean, standard deviation and coefficient of variation of general metrical measurements of axe by initial form.

Initial Form	Variable	Mean
Slab	Length	76.53
	Maximum Width	48.22
	Thickness	31.01
	Weight	164.70
Indeterminate	Length	88.28
	Maximum Width	82.90
	Thickness	52.05
	Weight	310.00

6.11. Axe manufacturing methods at Sanaganakallu site

Axe production processes in Area A seem, on current evidence, to have been carried out mainly within Feature 1. The abundance of surface stone scatters across Hiregudda hill suggests there may have been other such discrete axe production workshops and reduction areas located in the area during the later phase of Neolithic. Reduction sequence analysis indicates there were at least three separate methods employed for making axes within Feature 1: Method 1, Method 2 and Method 3.

Method 1

Involved the reduction of large unmodified blocks of dolerite into bifacially flaked axe blanks. Manufacturing axes in this manner involved four sequential stages of reduction. The first stage of reduction, raw material procurement, required access to large unmodified blocks of high quality, internally homogenous dolerite. Such blocks were (and still are) only available from the nearby quarried dolerite outcrops, and would most likely have required the excavation of mining pits into the subterranean rock mass. Second stage involved initial 'edging' of the stone blocks was by direct freehand percussion apparently using pieces of dolerite as hammerstones. Stage 2 seems to have been conducted both at the quarry sources and in Feature 1 and adjacent locales in Area A. At least two different early reduction strategies were recorded; 'unifacial bevelling' and 'alternate flaking', sometimes on the same core. Unifacial bevelling involved the removal of a series of unifacial flakes from one side of the clast using a single platform surface. The clast was then rotated and the negative scars from the previous removals used as platform surfaces for subsequent unifacial removals from the opposite face. Alternate flaking involved the removal of a flake from one side of the clast, after which the clast was rotated and the resulting negative flake scar used as a platform for the removal of flakes from the

opposite face. The third stage of reduction involved the invasive thinning and contouring of these bifacial 'rough-outs'. This seems to have taken place mostly within Feature 1 and adjacent areas, however a number of biface thinning flakes were noted among the quarrying debris at the Lower Quarry also. Finally (fourth stage of reduction), these carefully manufactured bifacial axe blanks were then pecked and/or ground. A number of hammerstones were found in the assemblage that could provide evidence for the pecking process, though this was mostly inferred by the recovery of some partially pecked late stage axe blanks. As mentioned above, axe-grinding took place on a large granite quern located inside Feature 1 and apparently re-used for this purpose

Method 2

Involved a relatively more straightforward sequence of bifacial axe reduction. In this method flat slabs and tabular pieces of dolerite that were naturally shaped to the approximate thickness of an axe blank (c. 20-30mm). Natural clast types for Method 2 reduction would have been readily available in the local lithic terrain, and only minimal investment in mining activities would have been required to obtain significant quantities. The rock mass at the local quarried dolerite outcrops weathers naturally along internal cleavage planes into innumerable flat slabs, plates and tabular pieces of dolerite suited to Method 2 reduction.

Local colluvial sources and other secondary geological deposits were probably also targeted for slabs and flat cobbles of dolerite. Method 2 axes were manufactured by the alternate removal of relatively non-invasive flakes from around the perimeter of the stone piece. The use of non-invasive bifacial flaking techniques was probably a symptom of the natural thinness of the original stone packages, obviating the need for intensive thinning and contouring of blanks. The axes made by using this method show that the natural thinness of the slabs and tablets of dolerite available as weathered stone packages in the local dolerite sources seems to correspond with the mean thickness of axe blanks and axes in the assemblage. This suggests that Method 2 knappers may not have been concerned with substantially reducing the thickness of the initial clast types, but rather with modifying the length and width of axes.

Method 3

Involved the expedient retouch of small irregularly shaped pieces of flake and nonflake debitage, including random pieces of angular shatter, into both unifacially and bifacially retouched axe blanks. In this method the edge-grinding was usually minimal and confined to the formation of a functional working edge only. In this method the knappers used a particular type of flakes i.e., teardrop shaped flakes.

Conclusion

The Sanganakallu-Kupgal area is one of the richest and most significant prehistoric localities in India. While archaeological studies have previously been carried out in the area, most were conducted prior to the development of scientific studies in archaeology, and have focused only on very specific localities within a much wider and more diverse landscape of prehistoric remains Neolithic in the southern Deccan was associated with a number of key economic, social and ritual changes. These included changes in craft production patterns, associated with the gradual emergence of craft specialists in such areas as ceramic and stone axe production.

Sanganakallu-Kupgal area was a major manufacturing centre for axes and other lithic assemblages of the Neolithic period. The raw material needed to manufacture neoliths, the dolerite, occurs in the form of intrusive dyke within the granites in Hiregudda and this made it an ideal lithic production centre. The surrounding hills, Sannarachamma and Choudammagudda are mainly habitation sites. Large number of flakes from various stages of reduction and axe in various stage of production indicates that the site of F1 was a major axe production site where axes were made from slabs as well as sub-angular clast types. HGD Area B, was

also a major manufacturing center, but only one difference was, majority of axe from this site were manufactured axes from sub-angular clast types, whereas, the axes from F1 were manufactured from angular clast types. Lithic analysis at both locales indicates a focus on the extraction of naturally weathered rectangular blocks and slabs of dolerite, probably by digging directly down into subterranean deposits and levering up and wedging out suitably shaped pieces. Another important aspect at this site was from Area J and Area B of Hiregudda was a major axe manufacturing site.

From more detailed technological analyses, revealed that the variability observed in the axe and chisel production was due the use of different types of initial form and clast types at this site, but, all axes found at this site had a similar lateral symmetrical shape which was, only that the length of the axes changes according to phases. Axes from Herigudda and Sannarachamma revealed that in the early phase they are longer, wider, thicker and heavier that the axes found from the later phase irrespective of from which these axes were made i.e., initial form and clast types. The prolific concentration of surface and subsurface dolerite debitage and the scale of the (palimpsest) quarries seem to indicate that an extraordinary level of industrial activity took place at the site.

The earliest evidence for the large-scale 'mass production' of axes at Sanganakallu-Kupgal seems to coincide with the termination of the ashmound phase during the late Neolithic and the first appearance of metal. Dolerite was used for the manufacture of some stone tools during the main ashmound formation phase. (Although at present no petrographic data exists to substantiate the claim, it is presumed that the majority of this dolerite derives from one or more of the quarried outcrops at nearby Hiregudda). Only a single axe specimen testifies to the possible use of Hiregudda dolerite for manufacturing edge-ground axes. None of the other dolerite artefacts can be unambiguously identified as axe manufacturing debris, such as early and late stage bifacial thinning flakes. At the very least we can speculate, based on this data, that one or more of the dolerite outcrops at Hiregudda may have been exploited for the relatively small-scale production of edge-ground axes during the main ashmound expansion phase at Sannarachamma. Throughout the sequence at the nearby Birappa Rock-shelter and in the lowermost levels of Sannarachamma, flaked quartz predominates. Dolerite is very rare to absent in most levels at these sites. At least some of this flaked quartz material (which includes single and multiple platform core reduction, bipolar core reduction and blade core reduction) may be associated with pre-Neolithic hunter-foragers.

Unreduced and retouched pressure micro-blades of chert, chalcedony and quartz crystal are continuous throughout the sequence from the earliest to latest phases of Neolithic habitation.

Thus it would seem from the analysis that the first large-scale manufacture of dolerite axes in the Sanganakallu-Kupgal region post-date the use of the Sannarachamma ashmound. The onset of large-scale axe production relate to the final phases of Neolithic occupation at this site and the from the early phase of the Megalithic. This was the time during which the first traces of metal use at Sanganakallu-Kupgal begin to appear, mostly in the form of small amounts of copper beads, twirled wires and other items of jewellery and decoration. Perhaps the availability of ornamental metals as new items of prestige in south India spurred a major intensification of stone axe production and exchange at Hiregudda centred at discrete quarry workshop locales like Feature 1.

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